KU Leuven
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CAUSES AND PREVENTION OF LONG-TERM DISABILITY DUE TO LOW BACK PAIN

AN INQUIRY FROM THE PERSPECTIVE OF INSURANCE MEDICINE

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Promoter:
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Dissertation presented in partial fulfillment of the requirements for the degree of Doctor in Biomedical Sciences

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Translation cover

Title: Instructions concerning a sprain of a vertebra [in] his spinal column

Examination: If thou examinest [a man having] a sprain in a vertebra of his spinal column, thou shouldst say to him: "Extend now thy two legs (and) contract them both (again)." When he extends them both he contracts them both immediately because of the pain he causes in the vertebra of his spinal column in which he suffers.

Diagnosis: Thou shouldst say concerning him: "One having a sprain in a vertebra of his spinal column. An ailment which I will treat."

Treatment: Thou shouldst place him prostrate on his back; thou shouldst make for him....

(Cases 47 and 48 in the Edwin Smith Surgical Papyrus, 17th century B.C. in: Brandt-Rauf, P.W. and Brandt-Rauf, S.I. (1987). *History of occupational medicine: relevance of Imhotep and the Edwin Smith papyrus*. Br J Ind Med, 44(1): p. 68-70.)

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Acknowledgments

Fountain of mercy! whose pervading eye

Can look within and read what passes there,

Accept my thoughts for thanks; I have no words.

My soul o'erfraught with gratitude, rejects

The aid of language – Lord! – behold my heart.

(Hannah More, 1745-1833)

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List of abbreviations

LBP	Low back pain
NSLBP	Non-specific low back pain
RTW	Return to work
ALIF	Anterior lumbar interbody fusion
PLIF	Posterior lumbar interbody fusion
CI	Confidence interval
OR	Odds ratio
ROC	Receiver operating characteristic

PREFACE

This is a text dedicated to the problem of long-term disability due to low back pain and the key role insurance physicians play in it.

As a scientific researcher at the School for Public Health engaged in disability consultancy, I was astounded by the considerable number of failed back surgery patients. Furthermore, in my capacity as medical adviser, I reviewed a lot of low back pain disability claims with long-term sick leave lasting for up to 12 months and more. In addition, I witnessed an increase in claimants suffering from simple low back pain (LBP) unable to resume work within 3 months of sickness absence. That was the straw that broke the camel's back and I felt compelled to better understand what I was involved in and how to deal with it.

I searched the international literature and found a number of evidence-based guidelines covering the early treatment and management of persistent or recurrent LBP.[1] Likewise, controversy about utility of back surgery for various conditions spawned the development of clinical practice guidelines based on existing evidence.[2, 5]

Despite of all scientific advance in LBP, back pain leading to disability remains an everyday problem for far too many people and a conundrum for physicians involved in insurance medicine. In Belgium, roughly 260.000 persons have physical and mental impairments that interfere with their ability to work during more than one year. An estimated 70.000 persons are suffering from a life-long musculoskeletal disability including LBP.[8]

Until two decades ago, the advice to rest was common practice, but over the years this practice has changed towards guidelines to stay active.[3] Hence it's our experience that some treating physicians do make inappropriate recommendations regarding work resumption. The same finding apparently applies to spinal surgery where a lack of evidence about the effectiveness contributes to the perceived wide variation in its use and the ensuing disability. Are failed back surgery cases dead canaries in a coalmine prompting for immediate action?

Insurance physicians are in the driver's seat of disability claim assessment. But how do they perform compared to the expectations of treating physicians and, more importantly, what does society expect from them? Social security disability law is clear and unambiguous: medical advisers are allowed to establish or authorize a plan for progressive return to full duty and to provide information and guidance on the patient's behalf. This may be a challenging job given the traditional focus on disability assessment rather than disability management and health care research. The alleged value of improving claimant reassurance and provider feedback has yet to be proven.

The present manuscript attempts to address some of these subjects. The **first section** of the text gives an overview of the disability following lumbar spine surgery in Belgium. They are part of the challenges insurance physicians face in daily practice. One leitmotif in this section is the myriad of surgical options available for low back pain ranging from minimally invasive back surgery to advanced surgical procedures. The perceived ambiguity in the rapidly increasing use of spinal fusion surgery amid the paradigm shift to disc replacement needs further exploration. Chapter I gives an overview of the epidemiology, cost and outcome of lumbar disc hernia. Chapter II deals with disc replacement as compared to lumbar spinal fusion. The epidemiology of lumbar spine surgery over a decade is covered in Chapter III, including return to work, iterative surgery and mortality as outcome measures. The **second section** of this dissertation focuses on prevention of disability due to non-specific low back pain. Risk factors are detailed in Chapter IV that provides insight into the main factors of long-term disability. Chapter V addresses the screening for delayed work resumption. Counseling to enhance return to work is covered in Chapter VI.

"*I am sitting in the shade today because someone planted a tree a long time ago.*"[6]

This work originates in the roots of the theory on human damage pioneered by Professor J. Van Steenberge, Professor J. Viaene and Professor D. Lahaye.[10] They fully embraced the idea that an ounce

of prevention is worth a pound of cure. Much of the shade however is provided by the oak branch of Professor P. Donceel who successfully conducted exhaustive in-depth research on the prevention of disability following surgery for disc hernia.[4]

I am convinced that insurance physicians need to align disability evaluation and management with evidence based practice. What matters most is that we are providing the best strategies to prevent or lessen the risk of chronic disability in compliance with legal frameworks or policy requirements. Through my prospective research, I attempted to impart a practical screening tool to insurance physicians in general and provide key messages for medical reassurance. It is my hope that this dissertation will provide colleagues with practical and useful ideas to benefit their practice.

The text also attempts to provide a convenient forum for discussing more specific issues that are important in the prevention of disability, such as lack of motivation as a sign of decrease in tolerance.

Disability following LBP is a health condition that overlaps among the varying health care providers. I wrote this text not only for medical advisers and insurance physicians in general, but also for those involved in multidisciplinary management of disability.

"*What's in a name? That which we call a rose. By any other name would smell as sweet.*"[9]

Following Shakespearean wisdom not to reveal a name, I would like to express my deepest appreciation and gratitude to my beloved, my family, my fellows, the Alliance of Christian Sickness Funds and my Alma Mater. To put it briefly, all people directly or indirectly involved in the preparation of this manuscript. Without their support and patience it proved to be an ongoing Sisyphean task.

According to W.L. Phelps, there are two classes of readers: those who read to remember and those who read to forget.[7] I sincerely hope you belong to the former and that this work will inspire many to

personally contribute to the advance of medical science and help students to pursue their aspirations in the field of Insurance Medicine.

Marc Du Bois

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GENERAL INTRODUCTION

Du Bois, M. (2012). *Aspecifieke lage rugpijn en arbeidsongeschiktheid*. Consilio Manuque 2012/02: p. 55-61 (adapted version).

"*Congress acknowledged that society's accumulated myths and fears about disability and disease are as handicapping as are the physical limitations that flow from actual impairment.*"

(William Joseph Brennan, Jr., 1906-1997)

Setting the scene

When Imhotep (2655-2600 B.C.) described the sprain of a vertebra as an occupational injury in the Edwin Smith papyrus, he did not anticipate that the disease would grow to epidemic proportions in modern western society, still racking the brains of physicians of many specialties, including physicians practicing insurance medicine.[3] Unfortunately, the described case was incomplete, lacking any prescription of treatment, leaving modern medicine to fend for itself.

The facts are compelling: low back pain (LBP) is one of the most common health problems affecting 80 to 85% of the population.[31] In developed countries, LBP is the most frequent occupational complaint and develops into chronic back pain often with long-term disability in 2 to 5% of the cases. It also constitutes the most frequent complaint of activity restriction in the young and adult population and it is the second cause of sick leave.[15] It's no surprise that LBP is an important economic problem including expenditures for health care and indemnity payment, productivity loss and litigation.

The natural course of LBP is variable. Episodes of pain occur frequently, but mostly the final prognosis is favorable with a complete recovery. 75% of the LBP complaints disappear within a month with 90% of individuals recovering within 3 months of onset in most cases.[12] This view justifies that clinicians often need do nothing more than simply reassure patients that they will likely recover. However, recurrences are frequent and are often progressively worse over time.[8]

LBP rarely causes death and by contrast with infectious diseases, cardiovascular disorders and cancer, it is not considered to be a major health threat. Yet, epidemiological studies point to an increase of serious low back disorders among older people and a growing prevalence among adolescents.[14]

For patients with acute low back pain of unknown origin or without identifiable pathology, the so-called "non-specific low back pain (NSLBP)", the primary emphasis of treatment should be conservative

care, time, reassurance, education and activity as tolerated.[34] The place for surgery in chronic NSLBP is very limited and its overuse has been criticized.[1] At the current state of knowledge, surgery for chronic NSLBP is no better or worse than a combined physical and psychological treatment program. However, spinal fusion surgery has more complications and lower cost-effectiveness. The findings of trials that assess new methods of surgical treatment, including disc replacement, show similar clinical outcomes to fusion and intensive rehabilitation.

For radiculopathy with herniated lumbar disc, standard open discectomy and microdisectomy are moderately superior to nonsurgical therapy through 2 to 3 months.[4] For symptomatic spinal stenosis with or without degenerative spondylolisthesis, decompressive surgery is moderately superior to nonsurgical therapy through 1 to 2 years. Insufficient evidence exists to judge long-term benefits or harms of artificial disc replacement.[29]

In daily practice, the medical adviser is often confronted with the socio-economic consequences of back operations. That is why LBP should be given the complete attention with emphasis on prevention. An epidemiological investigation of the impact of surgery on LBP in Belgium is a first step in this process.

In 2008, the International Labour Organization underscored the importance and the meaning of work for a sick or a healthy person: work is not only an economic item but also a means allowing a person to prove his talent, self-confidence and self-respect and to participate fully in society.[16]

The high cost and the important morbidity resulting from chronic LBP require an insurance medicine policy directed at the prevention of chronic disability.[6] Now it is generally accepted that a longer than medically necessary incapacity for work has an invalidating effect. Patient activity levels, including work resumption, are a key factor in recovery.[18] To what extent insurance medicine can contribute to an early and safe resumption of work by claimants suffering from LBP has not been established yet.

Still scientific research makes it clear that the development of chronic pain is the resultant of several individual, work related and psychosocial factors.[23] In literature however little is known about the factors that can predict the duration of incapacity and the return to work in the initial phase of incapacity due to LBP especially within the Belgian social security system.[30]

Insurance medicine in Belgium

Insurance medicine is the application of the science and art of medicine to the assessment of the life and health insurance risk. The discipline encompasses risk appraisal, prognosis, or the forecasting of the time of death and the liability to disability due to accident or disease.[10] Physicians practicing insurance medicine work within the fields of life, health, disability and long-term care insurance either in private or social settings. They analyze medical records of applicants to determine insurance risk and to evaluate life and disability claims. In Belgium, medical advisers practice insurance medicine within the compulsory health insurance system that covers the entire population and is organized through private, non-profit sickness funds. The role of a medical adviser differs from the clinical role of establishing a diagnosis and providing treatment. Medical advisers decide on the reimbursement of health care and are primarily involved in disability assessment and entitlement. They further educate both health professionals and claimants about disability and quality of health care.

Disability is defined as the impact of impairment on a person's ability to perform an activity in the manner or within the range considered normal for a human being.[5] In the Belgian social security system evaluation of disability is generally performed in the context of a person submitting a claim for work incapacity to a sickness fund filled out by a treating physician. In brief, disability for blue or white collar workers is defined by law as a reduction of earning capacity caused by injuries or functional disorders to one third or less of that of a reference person according to his present occupation, or with all

possible occupations in which they could be employed. Conversely, a self-employed person is legally incapable to resume work if an injury or disease necessitates to terminate his occupation as a self-employed worker, and he does not qualify for any other occupation, either as a self-employed, wage earner or public servant. By law, the medical adviser can facilitate early return to work by authorizing a return to work on a part-time basis while the claimant still receives partial disability benefits.[24] It follows that disability assessment has a broader focus than evaluation of impairment because factors such as essential requirements of a job, educational level of the patient, transferable skills, and potential for retraining have to be taken into account.

The basic sickness benefit arrangements vary greatly between European countries. As mentioned earlier, Belgium sets the minimum level of loss of earning capacity to qualify for receiving sickness benefit at 67%, while for most European countries, the required degree of long-term incapacity ranges between 50 and 67%. For employees, sickness benefit payment in Belgium starts after one month, i.e. when the guaranteed salary period paid by the employer is over. As a general rule, sickness benefits in Belgium amount to 60% of earnings limited to a predefined maximum. In European countries, the wage replacement level varies between 50% of earnings covered and 100% of basic hourly earnings with duration of payments limited to one year or without formal limit. Disparities in compensation schemes may constitute sources of bias in drawing valid inferences from return to work studies, especially when conducted in different social security systems. However, an international literature review on social security benefits and incapacity for work suggests that the financial level of benefits only has a relatively small effect on the number of claims and duration of payments.[33] The availability of compensation and the control mechanisms instead have a more significant impact. As a result, this study points to the role of medical advisers as gatekeepers of the social security system.

In daily practice, the key elements of a disability assessment include a comprehensive history taking, clinical evaluation and the application

of appropriate objective tests.[27] These elements enable the medical adviser to establish the diagnosis, characterize the severity of impairment, and map the claimant's abilities and restrictions so as to give a final verdict on the disability. It is apparent that from a practical point of view, earning capacity is appreciated through common sense since the disappearance of piecework in modern society made it technically impossible to determine disability. In conclusion, proper assessment of medical fitness for work balances functional status against job demands, in line with current practice in the UK.[21]

Disability assessment and LBP in a social security setting in Belgium

Disability can be viewed in many ways.[28] These include at least a biomedical model and a bio-psycho-social paradigm. The classical biomedical model focuses on pathophysiology and other biological approaches to disease and works well in dealing with specific LBP where the underlying pathology can be identified reliably. This is usually not the case with soft tissue injuries such as non-specific low back pain (NSLBP), where by definition no clear causality can be identified.[20] Therefore, NSLBP is best understood within a bio-psycho-social framework. The bio-psycho-social approach systematically considers biological, psychological, and social factors and their complex interactions in understanding disease. Wrong ideas (misconceptions?) and expectations regarding pain and functional restraints are have been identified as key personal and psychological factors.[11] Non-specific LBP or common LBP is a diagnosis of exclusion which affects 85-90% of all patients seeking care and includes pain in the lumbar region that may radiate to one or both thighs but not below the knee.[20] The application of the bio-psycho-social model in insurance medical practice for LBP has been studied scientifically to a small degree. In practice the approach to disability evaluation is far from consistent. Many medical advisers accept the

biomedical mindset, only a few think with a rehabilitation oriented approach.

The insurance physician not only evaluates, but also plays an important part as a counselor. While evaluating incapacity the medical activities are directed at the recovery, the preservation or the promotion of the health and the social balance of the insured. In principle resumption of work is aimed at.[13] One of the basic theorems of insurance medicine is that work is good for man and that it is the physician's role to encourage work and return to work as part of the treatment.[32] The process of recovery and resumption of work is best understandable from a bio-psycho-social approach, challenging traditional biological medical thinking in which a clear causality for the pain can be identified. The bio-psycho-social model for NSLBP is used to identify factors associated with delayed recovery.

The translation of prognostic determinants of long-term disability because of LBP in a clinically workable screening instrument for the medical adviser remains an important challenge. Indeed quick and simple detection of patients with a high risk of chronicity is primordial for the success of an optimal guidance of the incapacitated back patient.[9]

One of the first trials in a clinical curative setting was the introduction of the concept 'yellow flags' which tried to stimulate the physician to evaluate the psychosocial factors in addition to clinical examination and history taking The concept of 'flag identification' was extended further and refined with other known prognostic entities of LBP. So environmental factors including both employer and insurance system characteristics were marked as 'black flags' and the individual perceptions and attitudes towards the working environment as 'blue flags'.[19, 26] 'Red flags' point to possible signs of more serious spinal pathology such as spinal tumor and infection or inflammatory disease. They require a specific (semi-)urgent approach.[25] However, the position of this basically curative arsenal in the insurance medicine practice is still to be clarified.

In his role as a counselor it is important for an insurance physician to recognize the different phases of back complaints. In international literature a distinction is made between acute LBP (six weeks or shorter), subacute LBP (six to twelve weeks) and chronic LBP (longer than twelve weeks or in case of frequent relapse).[2] The patient should keep or resume his normal activity pattern, even in pain. Don't let the pain be your guide is the leitmotif.[20]

In acute non-specific lower-back pain emphasis is laid on education, advising and reassuring of likely positive prognosis, continuing ordinary activity within the limits permitted by pain and later on the gradual extension of the activities independently of the expressed complaints.[35] Essential is that the physical activity increase is time- and not pain contingent.[22] After six weeks, and sooner if the recovery stagnates, the physician checks whether a specific cause lies at the basis of the LBP. If not, he stresses again the innocent character of the pain and the advice to increase the activities step by step. As already mentioned above, surgical indications for treating chronic NSLBP are ill defined.[20]

The importance of education, advice and reassurance in the follow-up by the insurance physician with a view to the professional reintegration for LBP, is insufficiently scientifically founded.[17] In a dissertation it was shown that the timing and the content of the insurance medicine policy have a great impact on the length of the incapacity for work after surgery for lumbar disc hernia.[7]

Scientific research of the impact of this policy in the setting of the Belgian insurance medicine practice has a high social relevance in the light of the medico-social burden of LBP.

Objectives of the research

1. Objective and research questions

The general objective of this dissertation is to examine how the insurance physician in his role as a counselor can contribute to the

recovery of claimants suffering from LBP and thereby prevent long-term disability.

The following research questions were investigated:

- What is the epidemiology of spinal surgery in Belgium?
- What is the social and economic burden of spinal surgery in Belgium in terms of return to work, iterative surgery and social security costs?
- What factors predict long-term disability because of LBP?
- What are the best questions to identify LBP claimants not returning to work?
- What is the effect of LBP information and claimant reassurance on work resumption?

2. Methodology

A retrospective cohort analysis was performed to study the epidemiology and outcome of lumbar spine surgery. Claimant records were drawn from the administrative database of the Alliance of Christian Sickness Funds which represents 42% of the mandatory insured population in Belgium. Logistic regression was used to evaluate associations.

Risk factors of long-term disability were investigated through a multicenter prospective clinical cohort study. Research variables comprised the clinical assessment (symptoms, clinical signs, history and functional capacity, patient behavior, patient's expectations and activity), psychosocial (depression, somatization and stress) and professional factors (physical load, ergonomics and job satisfaction). A multivariate logistic regression analysis was performed to identify risk factors. The set of questions that best predicted the RTW status was used in another claimant sample to develop a practical screening tool for use in a disability evaluation setting.

To investigate the impact of counseling on LBP, claimants were randomized into an intervention group and a usual care control group. The primary outcome was RTW at 3-month and 12-month follow-up. Secondary outcomes included sick leave recurrence, subsequent surgery and sick leave duration. Proportions were compared using standard chi-square tests.

3. Significance of the study

The current study explored the incapacity for work and the social burden on claimants who underwent surgical treatment because of back complaints. In that way this dissertation is to be linked with recent doctoral research into the contribution of insurance medicine after a surgical treatment of the lumbar spine, placing surgery in Belgium in a critical perspective. Determinants of long-term disability because of LBP were also probed. These factors can play a role in the early identification by the medical adviser of claimants at risk for a long-term disability. Next, our study examined the development of a predictive model for long-term disability due to LBP. A practical predictive screening tool can be used in daily practice by medical advisers. Finally the impact of the medical adviser as a counselor in a population of LBP claimants was examined. More specifically, our research investigated if a scientifically based intervention protocol directed at quick mobilization and reintegration results in a quicker and lasting resumption of work. The findings may alter the way medical advisers deal with disability evaluation.

4. Outline

This dissertation is divided into two sections. Section 1 builds on the experience gained within the School of Public Health's research group on disability after lumbar disc hernia and comprises three retrospective investigations. Section 2 comprises prospective research in a social security setting and deals with the problem of NSLBP.

Section 1 contains three studies relating to the first research question and forms an integral part of the problem definition. The first is a retrospective study on the epidemiology, return to work and cost of

surgery for disc hernia. The second paper reports on a comparison between disc replacement and lumbar spinal fusion. The third paper provides an overview of the lumbar spine surgery in Belgium over a decade with regard to outcome and practice variability.

Section 2 comprises three papers relating to the return to work in a cohort of claimants suffering from NSLBP. The first study investigates the biological, psychological en social factors that predict long-term disability. The second paper aims to develop a screening instrument readily available to medical advisers for use in daily practice. The third report is a randomized controlled trial to investigate the impact of counseling on return to work rates during disability assessment.

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SECTION 1

LOW BACK SURGERY

CHAPTER I

EPIDEMIOLOGY, OUTCOME AND COSTS OF SURGERY FOR LUMBAR DISC HERNIATION

M.G. Du Bois and P. Donceel (2004).
In: Szpalski, M., Gunzburg, R. and Andersson, G. (eds.), Degenerative disc disease. Philadelphia: Lippincott Williams & Williams: p. 313-320.

"*No operation should be carried out unless absolutely necessary nor should a surgeon operate unless he would undergo the same operation himself in similar circumstances.*"

(John Hunter, 1728-1793)

Abstract

Low back pain due to disc hernia imposes a significant social and economic burden on western society. Restrained health care budgets keep stakeholders focused on outcome measurement and spinal surgery eligibility.

The present study was aimed at assessing surgery rates of lumbar disc hernia in Belgium and to evaluate surgical outcome and social security costs. Subjects were Christian Sickness Fund enrollees who underwent surgery for lumbar disc hernia in 1999 with one year of follow-up. There were 1431 eligible claimants of whom 8% underwent combined discectomy and fusion. The duration of hospital stay ranged between 4 to 12 days for standard surgery and from 8 to 18 days for combined discectomy and fusion.

After combined discectomy and fusion 55,4% of the patients were unable to resume work. A short period of work incapacity before surgery, younger age, male gender, white collar worker and standard surgery were associated with work resumption one year after surgery. The most important factor related to post surgery outcome was length of work incapacity before intervention. Using records of the National Institute for Health and Disability Insurance, the rate of combined discectomy and fusion was estimated at more than twice the standard surgery rate. Fusion surgery social security expenditures were double the standard surgery costs. Prudent decision making when considering surgery and screening for presurgical period of work incapacity may improve the success rate of spine surgery.

Background

The epidemiologic and economic impact of low back pain (LBP) and herniated discs in industrialised countries is enormous. Low back pain affects up to 80% of adults at some point during their lifetime. Of these, about 1% becomes totally disabled, the LBP becomes chronic in 10%, and the rest recover uneventfully, with 80% returning to work in 8 to 10 weeks. In the Netherlands, approximately 7,5% of the population have either chronic spinal disorders lasting longer than 3 months or a herniated disc at some point. In the United States in 1989, the rate of disability exceeded the rate of population growth by a factor of 14, and the estimated total workers' compensation cost for LBP was 11,4 billion dollars.[2, 8, 10]

In approximately 2% of cases, LBP results from acute herniation of an intervertebral disc. Herniated nucleus pulposus is one of the indications most frequently leading to temporary absence from work. Furthermore, herniated discs are one of the most frequent causes of entitlement to disability benefits.

In some patients with a herniated disc, symptoms persist despite conservative treatment. They may become candidates for surgery. Outcome studies of lumbar disc surgery have documented success rates between 23% and 95%. Rates of return to work vary between 50 to 90%.[5] It is generally assumed that reported outcomes in patients undergoing surgical procedures for lumbar disc herniation are poorer in patients receiving workers' compensation. The present study has been performed to investigate the situation in the Belgian population.

In Belgium, as in other Western countries, awareness of the social and economic burden that common and chronic diseases impose on society is increasing. Providers, payers and regulatory authorities are focusing on advancing the quality of care within restricted budgets by emphasising patient outcomes and evaluating physician's practices. In this sense, lumbar disc herniation is a case in point in an increasingly restricted health care environment.

The present study was carried out to determine the rates of surgery for lumbar disc herniation in Belgium. A second objective was to describe the surgical results and predictors of outcomes in terms of hospital stay, return to work and use of medication. A third objective was to analyse the social security costs related to surgery for lumbar disc herniation.

Materials and methods

The study was a retrospective cohort design. Records from the National Sickness and Invalidity Authority were used to calculate the trends in the rates of surgery for lumbar disc herniation from 1989 to 2001. Surgical rates were calculated by dividing the number of treated patients by the year-specific total Belgian population. Rates were not adjusted for demographic parameters.

All medical and compensation payments in addition to patients' medical files from the Christian Sickness Fund were reviewed to delineate the outcome of surgery. The Christian Sickness Fund is the largest sickness fund in Belgium, covering approximately 45% of the mandatory insured population. Between January 1999 and January 2000, 1431 enrollees in the Christian Sickness Fund underwent surgery for lumbar disc herniation. Of these, 8% underwent combined discectomy and fusion.

We recorded the following variables for each patient: age, gender, type of surgery, occupation, period of work incapacity before surgery, length of hospital stay, use of medication, and period of work incapacity after surgery. Patients were evaluated by medical advisers of the Christian Sickness Fund. Their judgement of fitness for work is based on the patient's last job during the first six months of work incapacity. After six months of incapacity, the evaluation considers all occupations in which the patient may have engaged according to professional career and education.

To assess outcome of treatment, patients were classified into two outcome categories. A bad outcome was defined as the inability to resume work one year after surgery. Outcome was also measured in terms of the use of opoids three months before and three months after surgery. Hospital stay was used as a parameter to measure the process of surgery for disc herniation.

The cost assessment phase of the study determined the social security cost in the first year after surgery. Costs were calculated based on the official fees applicable in 1999. Costs attributable to lost productivity were not taken into account. The study more specifically compared the social security expenses of standard surgery with those of combined discectomy and fusion. During a review of the Christian Sickness Fund financial data, the medical costs of patients undergoing surgical treatment were broken down into hospital costs, surgeon's fee, and costs of anesthesia, radiology, office visits and follow-up rehabilitation. The expenses were converted into 2001 euros.

Statistical analysis

Microsoft Excel 97-SR2 and SPSS 10.0 for Windows were used to perform statistical analysis. Multiple factors were evaluated in a single variable model for their relationship to fitness for work after surgery. Potentially significant factors were then entered into a multivariate logistic regression model. The odds ratio was calculated for significant outcome predictors. The level used to determine statistical significance was p value of less than 0,05.

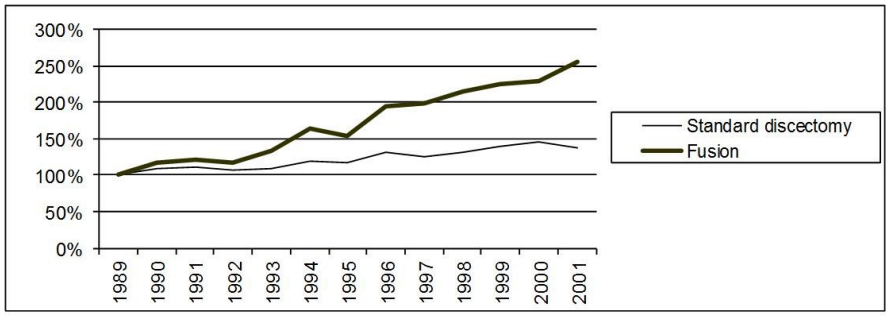
Results

1. Trends in surgery rates

Figure 1 shows the trend in surgery rates from 1989 to 2001. The rate of combined discectomy and fusion more than doubled over the 13-year period. The last three years saw a substantial decline in standard

surgery in favour of combined discectomy and fusion. The annual surgery rate for standard discectomy was 94 interventions per 100.000 enrollees. For combined discectomy and fusion, we found an annual rate of 12 operations per 100.000 enrollees.

FIGURE 1. EVOLUTION OF RATES OF SURGERY FOR LUMBAR DISC HERNIATION IN BELGIUM (1989 = 100%)



2. Hospital stay

The median duration of hospital stay after standard surgery was 8 days. For combined discectomy and fusion, we found a median hospital stay of 13 days. The hospital stay varied greatly within the major Belgian hospitals. The duration of hospitalisation ranges from 4 to 12 days for standard surgery and from 8 to 18 days for combined discectomy and fusion.

3. Fitness for work

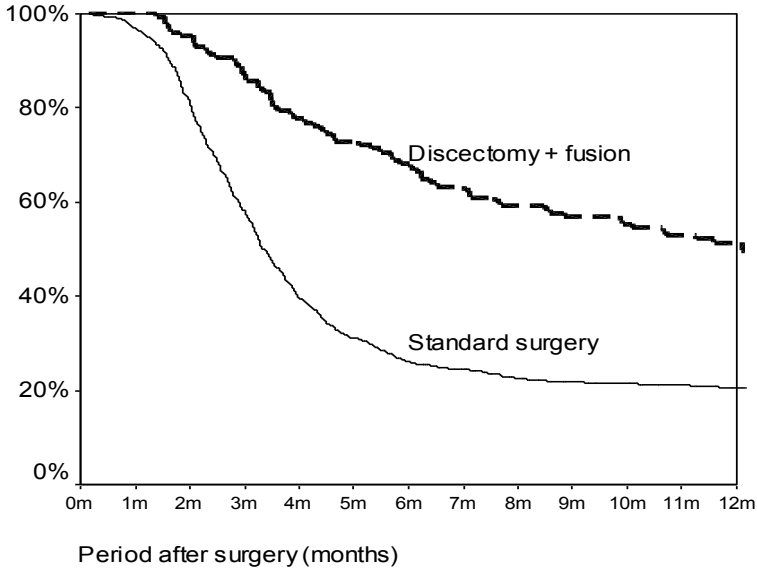
A total of 1.431 patients were treated for lumbar disc herniation. Of these, 65% were men and 35% were women (Table 1). The average age of the entire population was 41 years. The median duration of work incapacity before surgery for lumbar disc herniation was 6 months.

TABLE 1. PATIENT DATA

Characteristic	Mean (%)
Gender	
Male	65%
Female	35%
Occupation	
Self-employed	6%
Blue collar worker	60%
White collar worker	34%
Surgery	
Standard surgery	91%
Discectomy and fusion	8%
Age, mean	41 years
Duration of work incapacity before surgery, mean	6 months

Combined discectomy and fusion were performed in 8% of the patients. Combined discectomy and fusion resulted in a worse outcome than standard discectomy. Of the patients who underwent standard surgery, 20,2% were classified as having a poor result because they were not able to resume work one year after surgery. For combined discectomy and fusion, we found a poor outcome in 55,4% of the cases (Figure 2).

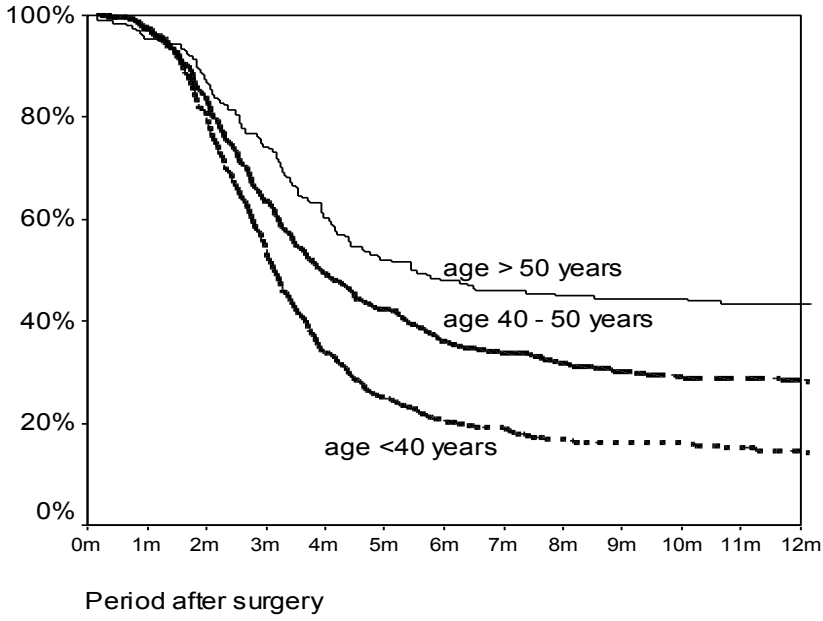
FIGURE 2. INCAPACITY FOR WORK AFTER SURGERY FOR LUMBAR DISC HERNIATION (N = 1.431)



The duration of work incapacity before surgery was significantly associated with return to work. 70% of the patients who had a work incapacity period longer than 3 months before surgery were unable to resume work one year after surgery.

The relationship between age and the disability rate is shown in figure 3. The highest rates of disability were found in patients that had the oldest age. Conversely patients younger than 40 years had the lowest rates of disability after surgery. Significantly more patients who were not able to resume work within one year after surgery were blue collar workers.

FIGURE 3. INCAPACITY FOR WORK AFTER SURGERY FOR LUMBAR DISC HERNIATION. OUTFLOW CURVES FOR SUBGROUPS IN DIFFERENT AGE CATEGORIES (OLDER THAN 50 YEARS, 40 TO 50 YEARS AND YOUNGER THAN 40 YEARS OF AGE)



The final regression model showed that a short work incapacity before surgery, younger age, male gender, white collar worker and standard surgery were significant factors for a high probability to be fit for work one year after surgery (Table 2).

TABLE 2. SUMMARY RESULTS OF THE STUDIED VARIABLES IN A LOGISTIC REGRESSION MODEL

	Variables in the equation					
	B	SE	Wald	df	Sig	Exp(B)
[a]Work incapacity			290,076	2	0,000	
Work incapacity 0-1 month	0,522	0,212	6,049	1	0,014	1,686
Work incapacity > 3 months	-2,572	0,212	147,629	1	0,000	0,076
Age			51,035	2	0,000	
Age 40-50 years	-1,595	0,230	48,086	1	0,000	0,203
Age > 50 years	-0,790	0,179	19,494	1	0,000	0,454
Woman	0,792	0,178	19,757	1	0,000	2,208
Occupation			12,515	2	0,002	
Blue collar	0,761	0,318	5,741	1	0,017	2,141
White collar	1,178	0,343	11,797	1	0,001	3,248
Standard surgery	1,380	0,245	31,711	1	0,000	3,974
Constant	-0,152	0,423	0,129	1	0,720	0,859

[a] *B, parameter estimate; SE, standard error of the parameter estimate; Wald, Wald statistic; df, degree of freedom; Sig, significance level for the Wald statistic, Exp(B), factor by which the odds change when the independent variable increases by one unit.*

4. Use of narcotics

A reduction in the use of narcotic pain medication after surgery was considered an indirect parameter of postoperative pain relief. Before standard surgery, 236 (59%) of the patients were using opoids. Three months after standard surgery 104 (26%) were still using narcotic pain medication. This finding demonstrates that standard surgery significantly affected the preoperative pain level.

5. Social security costs

Table 3 shows the direct social security costs associated with surgery for lumbar disc herniation. The total social security cost of standard lumbar disc surgery, including hospitalisation and the costs of the procedure itself, was found to be approximately 3487 EUR. However, significant differences in cost were found between standard lumbar discectomy and combined discectomy and fusion. The direct postoperative cost of combined discectomy and fusion, including the cost of follow-up physician visits and physiotherapy, was 7762 EUR.

TABLE 3. MEAN SOCIAL SECURITY EXPENDITURES DURING A ONE-YEAR PERIOD AFTER SURGERY FOR LUMBAR DISC HERNIATION

	Office visits	Orthopaedics	Radiology	In-hospital nursing
Standard	166 EUR	399 EUR	207 EUR	1497 EUR
Fusion	212 EUR	734 EUR	334 EUR	2454 EUR

Discussion

This study was retrospective and based on administrative files of patients' records from the largest sickness fund in Belgium. Important limitations of the present study include a lack of information on individual patients regarding preoperative and postoperative clinical manifestations, imaging study findings and specific complaints. The advantages of analysing the record files of an active population in Belgium include a uniform method for determining disability compensation, 100% postoperative follow-up, independent third-party evaluation and a uniform reimbursement schedule based on the National Sickness and Invalidity Authority.

We noted an increasing rate of surgery for lumbar disc hernia. In particular, procedures combining discectomy and fusion are on the rise. In Belgium, the annual rate was 12 operations per 100.000 enrollees. Traditionally, spinal fusion surgery has been the treatment of choice for persons who have not obtained relief of chronic back pain through conservative treatment. Lumbar discectomy is one of the surgical procedures most commonly performed in the United States, where in 1992 the rate of lumbar spinal fusion operations for degenerative spine conditions was estimated at 30,9 per 100.000. The rate is substantially higher today. The growing trend in spinal surgery mirrors the excellent results already obtained in addition to further development of spinal technology.[4, 8]

An objective analysis of the outcome in patients undergoing lumbar disc surgery is difficult because most of the criteria used in evaluation are based on problems of low back pain, persistent radicular

symptoms, limitations in physical activity and lack of a feeling of well-being. The objective of lumbar disc surgery is to relieve pain and restoring the patient to normal life. We attempted to measure the experience of pain according to the use of opoids before and after surgery and concluded that standard surgery relieves pain.

However, pain is subjective and difficult to assess quantitatively. In our study, outcome was therefore mainly measured in terms of fitness for work. Outcome was assessed by a medical adviser. This may be an advantage because patients tend to report better results to the surgeon or the surgeon's representatives than to a third party. Additionally, the evaluation of disability was uniform because it was based on the same compensation law. Medical advisers are physicians employed by sickness funds. Their main task is to evaluate work incapacity. Objectively, the criterion for fitness for work is that the patient must be able to perform the duties of their previous job or employment according to their level of education. When patients are judged unable to resume work, they are entitled to a monthly income. Additionally, if they cannot work for one year or longer, they are entitled to less expensive social insurance benefits.

Our results showed that 20% of all patients were still unable to resume work one year after standard surgery. For combined discectomy and fusion, this percentage increased to 55%. In a retrospective study, Saal [12] found that 90% of patients who underwent surgery for herniated disc associated with sciatica reported a satisfactory outcome; their rate of return to work was 92% at an average follow-up of 31 months. In the international literature, rates of return to work vary from 50% to 90%. Variations in surgical results relate more to selection factors than to either the quality of surgery or specific measures of outcome.

The lower return to work in the Belgian compulsory health care system with universal coverage is in agreement with the assumption that reported outcomes in patients undergoing surgical procedures for lumbar disc herniation are poorer in those receiving compensation. A thorough assessment of the role of the social security system is

difficult because of differences in disability benefits and legislation.[7, 21]

Whether to perform fusion in association with disc excision remains controversial. Several investigators have compared the results of disc excision alone with those of disc excision plus fusion. Some authors, such as Vaughan et al., have reported that performing lumbar fusion at the time of disc excision yields better results. In contrast, White et al. have reported that fusion is rarely indicated because equally satisfactory results can be obtained by disc excision alone.[15, 17, 18, 20]

We found that female gender and older age are to be associated with a bad outcome. Both female gender and lower income have been associated with poor outcome in other studies. In the studies of Junge et al. and Rasmussen, a poor outcome of lumbar disc surgery was associated with lower levels of education and income, among other factors.[6, 11]

Blue collar employment was significantly associated with a smaller chance of return to work. This finding may be a function of the more strenuous physical tasks required of blue collar workers. This difference may also be related to differences in job satisfaction and career commitment. Davis and Schade et al. found that manual labourers reported persistent or recurrent pain more often than persons performing more sedentary tasks.[5, 13]

When the data were subjected to multivariable analysis, the duration of work incapacity before surgery was the most important significant factor associated with fitness for work. This variable can be viewed as a feasible approach for predicting the patients' fitness for work of patients after lumbar discectomy or combined discectomy and fusion.

Our study reflects that patients who are being considered for lumbar disc surgery should be screened for long periods of work incapacity before surgery. Surgeons must consider preoperatively any psychological factors that may be affected by a period of work incapacity before surgery. It is becoming increasingly evident that a

poor outcome of lumbar disc surgery is most often a consequence of poor selection for surgery. Physicians agree that almost all patients with low back pain and sciatica caused by a herniated disc require less than 10 to 12 weeks of conservative therapy for recovery. The only absolute indication for surgery for lumbar disc disease is *cauda equina* syndrome. Lumbar discectomy is justified if a patient has persistent sciatica, neurologic signs of nerve root tension and imaging study findings that correlate exactly with the clinical findings.[1, 3, 19]

The median duration of hospital stay after standard surgery was 8 days, and after combined discectomy and fusion, it was 13 days. In the USA, a standard procedure for lumbar disc hernia is followed by a very short inpatient hospital stay of 1 to 3 days. Some authors have questioned whether inpatient stay is necessary after elective uncomplicated discectomy. Advances in anesthesia and surgical techniques have contributed to an increase in the number of discectomy procedures performed on an outpatient basis.

The average social security cost of combined discectomy and fusion was approximately double that of standard surgery. The difference was largely explained by the cost of implants and in-hospital nursing. In the present study, the greater economic burden of combined discectomy and fusion was evident. Given the substantial economic impact of herniated lumbar discs, the clinical and economic consequences should be taken into consideration by health care policy makers and physicians. Patients with a poor outcome of a first surgical intervention pose a medical challenge to physicians and are an economic concern because they rarely experience complete pain relief and are at high risk for long-term disability.

In view of these economic concerns, increasing the success rate of lumbar disc surgery by placing a major emphasis on "careful" patient selection to avoid costly failures should be a primary objective in a responsible health care environment.[9, 14, 16]

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CHAPTER II

OUTCOME AND COST OF LUMBAR DISC REPLACEMENT VERSUS LUMBAR FUSION

M.G. Du Bois and P. Donceel (2007).

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"*When the diagnosis is vague, the treatments are many.*"

(Nordin Hadler, 1994)

Abstract

Study Design. A retrospective study was conducted on administrative patient record files from the Alliance of Christian Sickness Funds, which is the largest sickness fund in Belgium covering approximately 42% of the mandatory insured population. By using the administrative database a retrospective cohort of 174 workers operated on with a non-reimbursed disc prosthesis and 310 workers who underwent combined discectomy and fusion were identified in 2003.

Objectives. To investigate the cost and outcome between spinal surgery using non-reimbursed implants and combined discectomy and fusion.

Summary of background data. Degenerative back disease is an important cause of pain and disability in Belgium and in the rest of the world. Spinal fusion as a standard surgical treatment increases the risk of adjacent segment degeneration. Modern disc arthroplasty evolves as an alternative despite limited evidence in research.

Methods. Records were made of each patient's age, sex, the surgeon's specialty, type of intervention, occupation, hospital stay and work incapacity before and after surgery. Multiple regression analysis was used to identify the factors associated with return to work. For all tests a 5% significance level was used.

Results. There was an overall upward trend in disc replacement with a yearly increase of 17%. The mean age at surgery was 43 years. Mean hospital stay was 7,9 days (range, 2-53 days) in the fusion group and 5,5 days (range, 1-35) in the disc replacement group. The return to work rates one year after disc replacement and combined discectomy and fusion were respectively 61,5% and 50,6%. In multivariate analysis, a long period of work incapacity before surgical intervention, older age, neurosurgeon and female were related to a long work incapacity period. Type of surgical intervention did not affect outcome. The social security cost of disc replacement surgery

including hospital stay was found to be 1.921 EUR. Patient co-pay is approximately 3.164 EUR.

Conclusion. This retrospective study with multivariate logistic regression analysis demonstrated no significant difference between the two surgery types in terms of return to work.

Introduction

Painful lumbar disc degeneration is the leading cause of pain and disability in adults in the United States and in the rest of the world. This represents a large socioeconomic impact with estimates of more than 50 billion USD in direct and indirect health costs in the United States annually. In most cases, degenerative disc disease can be treated successfully nonoperatively.[2, 3] There are, however, substantial numbers of people who have failed exhaustive nonoperative treatments and who seek surgical solutions for their incapacitating back pain. Currently, fusion is a widely accepted treatment for degenerative disc disease. However, outcome measures of fusion surgery show mixed results, particularly in the long-term. The innovative properties that artificial discs bring to the treatment of spine disorders through spinal joint replacement, as opposed to fusion, include: 1) relief of pain by maintaining spinal motion; 2) prevention of adjacent segment disease by eliminating adjacent joint-segment rigidity, lessening the potential for future disease-related events and surgeries; and 3) the continuance of a lifestyle that more closely resembles a preillness state.[3]

Objectives

We conducted a retrospective cohort study to establish whether disc replacement surgery can be performed with a better outcome comparable to combined discectomy and fusion. Our primary objective was to compare return to work rates after disc replacement surgery and combined discectomy and fusion. Determination of the costs associated with disc replacement surgery was our secondary objective.

Methods

Medical and financial claims data were abstracted from the administrative database of the Alliance of Christian Sickness Funds. This database is nationally representative for the Belgian population and includes data from 4.500 enrollees. All records including the reimbursement codes for combined discectomy and fusion between January 1, 2003, and December 31, 2003 were identified. A total of 310 patients met these criteria (fusion group). Next, 174 cases with disc replacement surgery were identified for the final dataset (disc replacement group). Patient age, gender, sick leave before surgery, employment state and surgeon's specialty were considered as covariates in the analysis. Detailed cost data incurred during the hospital stay were collected. The costs represent the cost of anesthesia, radiology tests, nursing, lodging, and implants. All reported costs are in 2004 Euros.

A logistic regression model at the patient level was developed to determine the predictors of return to work. Covariates significant at the 0,05 level in bivariate analyses were entered in the multivariate model in a stepwise manner. Statistical analyses were performed using SPSS 8.0.

Results

1. Patient characteristics

Study patients consisted of 310 consecutive patients who underwent combined discectomy and fusion and 174 consecutive patients in whom a disc replacement surgery was performed. Baseline characteristics of the two treatment groups differed in several nonmedical factors shown to predict subsequent work outcomes (Table 1). Overall, the combined discectomy and fusion group encompassed significantly more female patients, and significantly fewer operations were performed by neurosurgeons. Importantly,

these differences were taken into account by adjusting for these covariates in the logistic regression.

TABLE 1. CHARACTERISTICS OF PATIENTS

Disc replacement group N = 174 (No. = number; % = percentage)		
Characteristics	**No.**	**%**
Median age (years)	43	(Range: 25-70)
Gender		
Male	118	68
Female	56	32
Median sick leave before surg. (days)	1	(Range: 0-443)
Surgeon's specialty		
Neurosurgeon	130	75
Orthopaedic surgeon	44	25
Employment		
Blue collor	105	60
White collar	36	32
Self-employed	13	8
Fusion group N = 310 (No. = number; % = percentage)		
Characteristics	**No.**	**%**
Median age (years)	44	(Range: 22-72)
Gender		
Male	176	57
Female	134	43
Median sick leave before surg. (days)	4	(Range: 0-723)
Surgeon's specialty		
Neurosurgeon	182	59
Orthopaedic surgeon	128	41
Employment		
Blue collor	199	64
White collar	95	31
Self-employed	16	5

2. Outcomes

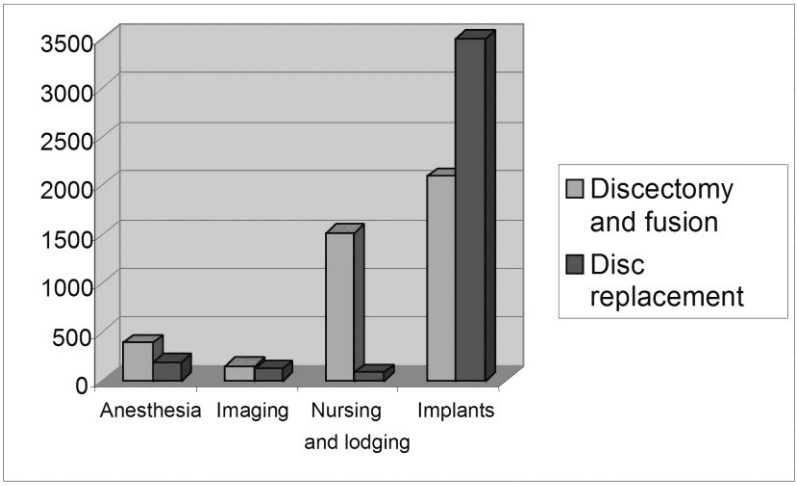
One year after surgery, the disc replacement group had a return to work rate of 61,5%. In the fusion group, 50,6% of the patients were able to resume work one year after intervention. Table 2 shows the logistic regression analysis of return to work one year after surgery. After adjusting for patient gender, age, period of work incapacity before surgery, employment, and surgeon's specialty, type of intervention was not associated with a higher return to work rate one year after surgery. This means that disc replacement surgery was not significantly better in terms of return to work than combined discectomy and fusion. This analysis also clearly shows the expected detrimental effect of long work incapacity before surgery. Another finding was that orthopaedic surgeons had faster return to work rates. The patients who had disc replacement surgery had a median hospital stay of 5 days (25th percentile to 75th percentile, 3 to 7 days) compared with 7 days (25th percentile to 75th percentile, 6 to 9 days) for those who had combined discectomy and fusion. The disc replacement group had lower costs for anesthesia, nursing, lodging and imaging during the hospital stay, but a 75% higher cost for implants (Figure 1).

TABLE 2. LOGISTIC REGRESSION ANALYSIS

	B	S.E.	Wald	df	Sig	Exp(B)
[a]Age	-0,029	0,013	4,870	1	0,027	0,971
Male	0,454	0,231	3,850	1	0,05	1,574
Work incapacity before surgery	-0,051	0,009	31,803	1	0,001	0,950
[b]Orthopaedic surgeon	0,653	0,221	8,704	1	0,003	1,922
[c]Self-employed	1,180	0,395	8,920	1	0,282	3,254
[d]Disc replacement	0,042	0,224	0,036	1	0,850	1,043
Constant	0,575	0,663	0,752	1	0,386	1,778

[a] *B, parameter estimate; SE, standard error of the parameter estimate; Wald, Wald statistic; df, degree of freedom; Sig, significance level for the Wald statistic, Exp(B), factor by which the odds change when the independent variable increases by one unit.*
[b] *Reference variable = neurosurgeon*
[c] *Reference variable = employed worker (blue and white collar)*
[d] *Reference variable = lumbar fusion*

FIGURE 1. MEDIAN IN-HOSPITAL COSTS (EUR)



Discussion

We reported the return to work rates and costs of disc replacement surgery and combined discectomy and fusion. In the current study, we examined the costs during the hospital stay of these procedures. Because patients who have disc replacement surgery cannot return to work earlier than those who have combined discectomy and fusion, disc replacement has no additional economic advantage compared with standard surgery for degenerative disc disease. The relative economic effects of these two procedures for longer periods remain to be determined. This especially applies for lumbar fusion given the well-known incidence of adjacent segment complications in the long run.

In a representative clinical follow-up study of the surgical disc replacement experience of Lemaire et al. [6], 82% returned to work of whom 72,7% continued the same level of activity. Nine percent did not return to work. These return to work rates are much higher than our findings owing to the type of compensation system in place.

Previous studies have shown that return to work rates are influenced more by nonmedical than by medical factors.[4, 7] After statistical adjustment for the effect of differences in baseline characteristics, patients who underwent combined discectomy and fusion or disc arthroplasty had indistinguishable rates of return to work. The major nonmedical factor associated with a poor return to work rate was the duration of work incapacity before intervention. This supports the general finding that few patients who are disabled for more than 6 months will return to work even if their physical health is fully restored. Because there is no single surgical standard for the treatment of chronic back pain attributed to degenerative disc disease, surgery may not be an option for these long-term disabled patients.

A prospective randomized study of the Charité artificial disc revealed that total disc replacement appears to be a viable alternative to fusion for the treatment of single-level symptomatic disc degeneration unresponsive to nonoperative management.[1] However, follow-up periods were no longer than 24 months. These follow-up periods are too short to advise arthroplasty as the procedure of choice in primary discectomy associated with long-standing back pain. Our study confirmed that there is no evidence that disc arthroplasty itself is superior in terms of return to work to combined discectomy and fusion in the short run.[5]

Our study has important shortcomings because of its retrospective design with a maximum follow-up of one year. Second, although conclusions were drawn after adjustment for some nonmedical differences, unregistered information about the medical condition before surgery and perioperative findings may be obscuring significant differences. The major strength lies in its multicenter and representative nature.

In summary, we observed similar return to work rates following disc replacement surgery and combined discectomy and fusion. However, days of hospitalization and costs were significantly lower with disc replacement surgery even after adjustment for population characteristics. Longer follow-up of this retrospective cohort and

additional randomized prospective clinical trials may help address the relative merits of different surgical approaches for degenerative disc disease. We strongly support attention to quality of life and costs in evaluating disc prostheses. Disc replacement surgery is a too costly procedure with unknown long-term health consequences to be performed without sufficient scientific backing.

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CHAPTER III

A DECADE'S EXPERIENCE IN LUMBAR SPINE SURGERY IN BELGIUM

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"*Chains of habit are too light to be felt until they are too heavy to be broken.*"

(Warren Buffet, 1930-present)

Abstract

Purpose. The purpose is to study rates, trends, geographic variations and outcome of lumbar spine surgery in the Belgian population during the last decade.

Methods. This is a retrospective cohort study using administrative data of the largest Belgian sickness fund from January 1, 2000 through December 31, 2009. Cases included lumbar laminectomy, combined discectomy and fusion, posterior interarticular fusion, anterior lumbar interbody fusion (ALIF), posterior lumbar interbody fusion (PLIF) and standard discectomy. The main outcome measures were age- and sex-adjusted rates of lumbar spine surgery, 1-year mortality, 1-year iterative surgery, no return to work (RTW) rate one year after surgery and length of hospital stay. Multivariate logistic regression analysis was used to determine the association between age, sex, geographic region, type of surgery, year of intervention and duration of pre-operative sick leave on outcome.

Results. Spine surgery rates rose 44% from 2001 through 2009 and data for 2009 showed twofold variations in spine surgery rates among 10 Belgian provinces. Reported 1-year mortality varied from 0,6% to 2,5% among surgical procedures performed in 2008.The overall 5-year reoperation rate was 12%. RTW rates one year after standard discectomy, ALIF, PLIF and combined discectomy and fusion for the follow-up sample of 2008 were 14,4%, 22,7%, 26,1% and 30,6%, respectively. The median length of hospital stay significantly decreased throughout the decade. Type of surgery and geographic region were significantly related to patient outcomes.

Conclusions. Regional variations highlight professional uncertainty and controversy. The study results point to the need for peer comparisons and surgeon feedback.

Introduction

In 85-90% of all individuals suffering from low back pain (LBP) no precise structure or systemic disease, infection, injury or trauma could be identified causing the pain. Standard treatment for this so-called non-specific lower-back pain when lasting between 0 and 12 weeks is essentially conservative and includes self-care with over-the-counter medication and maintaining activity as tolerated in the acute phase and a graded activity program and cognitive-behavioral treatment during the subacute phase. In cases of chronic non-specific lower-back pain due to degenerative disc disease based on provocative discography there is moderate evidence that surgery is as effective as intensive rehabilitation with a cognitive-behavioral emphasis.[24, 35]

In the few patients suffering from specific lower-back pain due to disc prolapse or spinal stenosis, nerve root pain usually represents about 5% of the pain.[3] Several randomized trials have compared surgery with conservative treatment.[4, 24] For radiculopathy with herniated lumbar disc, there is inconsistent evidence that open discectomy and microdiscectomy are superior to non-surgical therapy for long-term improvement in pain and function.[4] A randomized controlled trial demonstrated that one-year outcomes for patients assigned to early surgery and those assigned to conservative treatment were similar except for pain relief and perceived recovery, which were faster following surgery.[26] For spinal stenosis with or without degenerative spondylolisthesis, there is good evidence that decompressive laminectomy is moderately superior to non-surgical therapy for improvement in pain and function through one to two years.[4]

As a general rule, standard treatment for low back pain is essentially conservative in the absence of red flags.[2, 12] When medical management fails, spinal surgery is often performed despite its non-proven superiority.[2, 24] United States Medicare claims analysis has shown that lumbar spine surgery rates rose during the 1980s and between 1990 and 2003, which revealed tripling spinal fusion rates. Population-based research had clearly demonstrated variations in

proportion of spinal surgery across regions and subsequent geographic variations in outcome.[5, 9, 17] Regional variability is a hallmark of scientific uncertainty about the likely outcomes of spinal surgery. The internationally rising trend in spinal surgery despite constant LBP diagnosis rate and the wide US geographic variation in spinal surgery at least suggests that patients are not receiving appropriate care based on conventional wisdom. Whether that trend in more expensive clinical management of low back pain patients translates in devastating outcomes is not clear.

The objectives of the present study were both to examine recent trends of spinal surgery in Belgium and how it aligns with current international practice and to compare low back pain surgery in different geographic areas of the kingdom. An additional purpose was to determine the outcome of spinal surgery through a decade's experience.

Patients and methods

1. Setting

Belgium has a compulsory health insurance system with universal coverage organized through private non-profit sickness funds. The law requires inhabitants to join a sickness fund using a free choice enrolment model. Approximately, 42% of the entire Belgian population is legally insured through the Alliance of Christian Sickness Funds.

2. Data sources

All inpatient and disability claim files came from the administrative database of the Alliance of Christian Sickness Funds for all beneficiaries who underwent spinal surgery from January 1, 2001 through December 31, 2009. This database covers discharges from all hospitals where enrollees have been treated. The inpatient files contain beneficiary demographic data, dates of death, intervention procedure, admission date, discharge data en enrolment information.

Patient demographic characteristics included age, sex and state of residence. The disability claim files contain all sick leave periods for 100% of Christian Sickness Fund beneficiaries who were employed prior to spine surgery. The reimbursement database from the Alliance of Christian Sickness Funds is perceived to be reliable and accurate since it is subjected to audit by two independent supervisory agents.

3. Case selection

We studied lumbar spinal surgery. Data were retrieved using the Belgian nomenclature. This is a numerically encoded official fee schedule encompassing different medical acts and their accompanying reimbursement rate. Preliminary analysis of the Alliance of Christian Sickness Funds claims database showed that the top six most common procedures were lumbar laminectomy (nomenclature code 232805), combined discectomy and fusion (nomenclature code 281805), posterior interarticular fusion (nomenclature code 281643), anterior lumbar interbody fusion (ALIF) (nomenclature code 281665), posterior lumbar interbody fusion (PLIF) (nomenclature code 281680) and standard discectomy (nomenclature code 281783). We used the six nomenclature codes (232805, 281865, 281643, 281665, 281680, 281783) to identify cases from the medical bill payments database. The Belgian nomenclature is essentially procedure based and does not encompass International Classification of Disease (ICD-9) codes. Appropriate diagnoses were not available unless they were included in the description of a specific surgical procedure. The available codes do not indicate more detail about these procedures such as numbers of levels operated on and use of microsurgical techniques. We assigned each beneficiary to one of nine provinces according to zip code of residence, regardless of where they were hospitalized.

4. Analysis

The methodology and presentation were inspired by Patel et al. [25] who investigated the geographic variation in carotid revascularization. Surgery rates were analyzed using procedure counts as the numerator and the total number of beneficiaries as the

denominator. Rates for 2001-2009 were standardized age- and sex-adjusted to the 2000 Christian Sickness Fund enrollees which cover 42% of the compulsory insured population in Belgium. Return to work (RTW) was defined as resumption of full time activity within one year after surgery. We identified mortality as any death occurring within one year after surgery. A reoperation was counted if a second back operation was performed on the same individual during one year after initial surgical intervention.

Of the cases identified, no were excluded or had missing data. Aside from age, data were not normally distributed. Logistic regression makes no assumption about the distribution of independent variables and was therefore chosen to predict predefined discrete outcomes. A simultaneous entry logistic regression was performed to determine the magnitude of association of the independent variables with one-year mortality, one-year iterative surgery and one year return to work. Multivariate logistic regression was used to compare selected outcomes after adjusting for the following potential confounding factors: age, gender, year when surgery was performed, type of surgery and provincial region. One-year return to work was also adjusted for length of sick leave before surgery. The adjusted odds ratios (ORs) and 95% confidence intervals for the significant predictors were reported from the multivariate models adjusting for all the above-mentioned covariates. When considering geographic variation cases were attributed to the province of residence at the time of operation. All analyses were performed using SPSS software version 17.0. $P < 0,05$ is considered to be statistically significant.

Results

A total of 73.393 beneficiaries underwent lumbar spinal surgery from 2001 through 2009. The study subjects had a mean age of 52,7 years and 49,8% were women. Mean age was the highest among beneficiaries who underwent decompressive laminectomy (63 years) and the lowest in claimants who had ALIF (45 years). Table 1 shows the lumbar spinal surgery rates in this patient sample. The most

common surgical intervention was standard discectomy followed by lumbar laminectomy. The overall rate of spinal surgery in Belgium increased from 16,2 in 2000 to 23,3 in 2009. During the 10-year study interval, standard discectomy rate increased minimally, from 9,6 to 10,6 per 10.000 enrollees. The rate of PLIF rose slightly during this period from 1,4 to 2,0 per 10.000 beneficiaries. We also found a 50% increase in combined discectomy and fusion, and a nearly doubling of the rates of ALIF and lumbar laminectomy. This made ALIF and lumbar laminectomy one of the most rapidly increasing forms of spinal surgery in Belgium. The proportion of patients having spine fusion changed little from 20% in 2000 to 22% in 2009.

TABLE 1. NUMBER AND RATE OF LUMBAR SPINE SURGERY PROCEDURES BY YEAR (PER 10.000 BENEFICIARIES)

	Lami-nectomy		Posterior interarticu-lar fusion		ALIF		PLIF		Standard discectomy		Combined discectomy and fusion		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
2000	1524	3,4	67	0,1	372	0,8	624	1,4	4319	9,6	394	0,9	7300	16,2
2001	1528	3,4	82	0,2	394	0,9	664	1,5	3820	8,5	434	1,0	6922	15,4
2002	1648	3,7	102	0,2	361	0,8	705	1,6	4084	9,1	464	1,0	7364	16,3
2003	1879	4,2	98	0,2	468	1,0	676	1,5	4143	9,2	532	1,2	7796	17,3
2004	1981	4,4	62	0,1	604	1,3	713	1,6	4168	9,2	569	1,3	8097	18,0
2005	2321	5,2	74	0,2	682	1,5	752	1,7	4199	9,3	564	1,3	8592	19,1
2006	2470	5,5	114	0,3	675	1,5	840	1,9	4404	9,8	562	1,2	9065	20,1
2007	2898	6,4	111	0,2	598	1,3	848	1,9	4594	10,2	634	1,4	9683	21,5
2008	3323	7,4	119	0,3	599	1,3	847	1,9	4607	10,2	608	1,3	10103	22,4
2009	3489	7,7	139	0,3	662	1,5	888	2,0	4736	10,6	586	1,3	10520	23,3

Low back surgery rates among residents in nine provinces of Belgium are presented in Figure 1. Substantial geographic variation was seen in the age-adjusted rates of spinal surgery in the 2009 period, with a nearly twofold difference between the highest ratio of provincial rate of lumbar spine surgery to the Alliance of Christian Sickness Funds population average (1,41 in West Flanders) and the lowest rate (0,69 in Liege). Apart from Luxembourg, rates in the predominantly French-speaking southern region of Belgium were below the Dutch-speaking region of Flanders in the north.

Variations in the use of posterior interarticular fusion, ALIF, PLIF and combined discectomy and fusion were significantly more pronounced than for standard discectomy and lumbar laminectomy over the studied period. Rates of ALIF and PLIF varied approximately twofold among geographic areas whereas rates of posterior interarticular fusion and combined discectomy and fusion varied threefold. The coefficient of variation in surgery rates was similar when comparing total hip arthroplasty (21,3) with standard discectomy (25,6) and laminectomy (26,2) and below the magnitude of variability in rates of fusion (at least 55,1) in accordance with the results of Weinstein et al.[37]

FIGURE 1. RATIO OF PROVINCIAL RATE OF LUMBAR SPINE SURGERY TO THE ALLIANCE OF CHRISTIAN SICKNESS FUNDS POPULATION AVERAGE IN BELGIUM, 2009

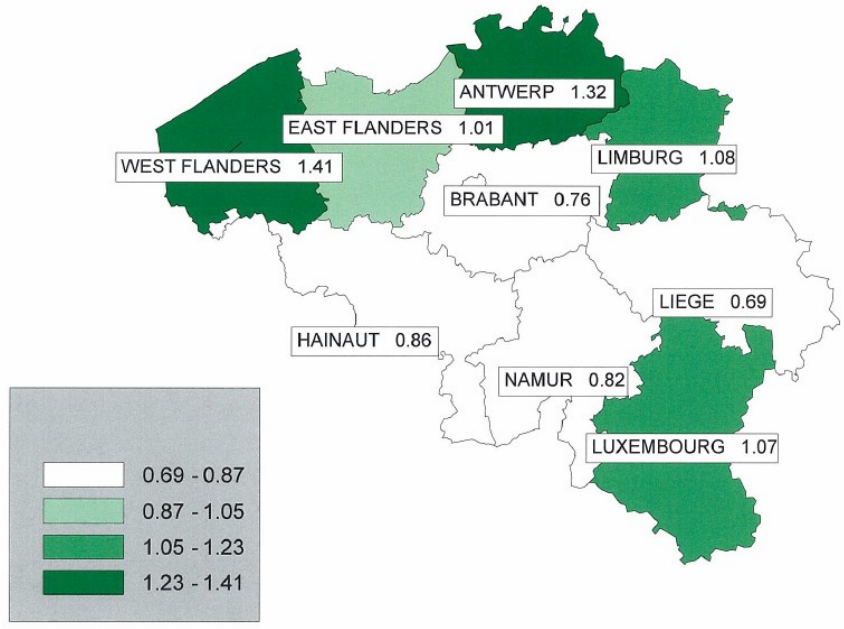

Table 2 shows the factors associated with the use of types of spinal surgery. Lumbar laminectomy was performed more often in older patients. More female underwent ALIF, PLIF and combined discectomy and fusion. Posterior interarticular fusion is less likely to be used in Antwerp whereas ALIF was more likely to occur in East Flanders. Standard discectomy was more likely to be used in Liege at the expense of PLIF. Combined discectomy and fusion and decompressive laminectomy is likely to be more popular in Antwerp. Lumbar laminectomy, posterior interarticular fusion and ALIF were statistically significantly gaining interest in the course of the last decade in disfavor of standard discectomy.

TABLE 2. VARIABLES ASSOCIATED WITH THE TYPE OF LUMBAR SPINAL SURGERY

	Lumbar laminectomy		Posterior interarticular fusion		ALIF		PLIF		Standard discectomy		Combined discectomy and fusion	
Variable	*P* value	Adjusted OR (95% CI)	*P* value	Adjusted OR (95% CI)	*P* value	Adjusted OR (95% CI)	*P* value	Adjusted OR (95% CI)	*P* value	Adjusted OR (95% CI)	*P* value	Adjusted OR (95% CI)
Age	< 0,001	1,07	0,23	1,00	< 0,001	0,96	< 0,001	0,99	< 0,001	0,97	< 0,001	0,99
Female sex	0,38	1,02	0,15	0,91	< 0,001	1,49	< 0,001	1,26	< 0,001	0,78	< 0,001	1,22
Belgian province			< 0,001		< 0,001		< 0,001		< 0,001		< 0,001	
Antwerp	Reference		Reference		Reference		Reference		Reference		Reference	
Brabant	< 0,001	0,85	< 0,001	4,70	0,38	0,95	< 0,001	1,77	< 0,001	1,28	< 0,001	0,37
West Flanders	< 0,001	0,57	< 0,001	5,84	< 0,001	1,37	< 0,001	2,56	< 0,001	1,29	< 0,001	0,31
East Flanders	< 0,001	0,92	0,04	1,41	< 0,001	2,84	< 0,001	2,05	< 0,001	0,86	< 0,001	0,31
Hainaut	< 0,001	0,69	< 0,001	4,14	0,13	0,88	< 0,001	1,49	< 0,001	1,34	< 0,001	0,64
Liege	< 0,001	0,48	< 0,001	5,59	0,03	0,81	< 0,001	0,27	< 0,001	2,94	< 0,001	0,22
Limburg	< 0,001	0,50	< 0,001	1,87	< 0,001	2,02	0,17	0,93	< 0,001	2,06	< 0,001	0,21
Luxemburg	0,72	1,02	< 0,001	16,01	0,02	1,29	0,11	1,17	0,70	0,98	< 0,001	0,36
Namur	0,34	0,95	< 0,001	8,60	0,01	1,29	< 0,001	0,60	< 0,001	1,40	< 0,001	0,27
Index year			< 0,001		< 0,001		0,10		< 0,001		< 0,001	
2000	Reference		Reference		Reference		Reference		Reference		Reference	
2001	0,37	1,04	0,07	1,35	0,14	1,12	0,07	1,11	< 0,001	0,97	0,02	1,18
2002	0,32	1,04	< 0,001	1,60	0,53	0,95	0,06	1,12	< 0,001	0,89	0,03	1,17
2003	0,09	1,08	0,03	1,41	< 0,001	1,24	0,93	1,01	< 0,001	0,84	< 0,001	1,29
2004	0,02	1,11	0,47	0,88	< 0,001	1,55	0,99	1,00	< 0,001	0,79	< 0,001	1,34
2005	< 0,001	1,24	0,64	0,92	< 0,001	1,71	0,98	1,00	< 0,001	0,72	< 0,001	1,28
2006	< 0,001	1,25	0,02	1,43	< 0,001	1,62	0,19	1,08	< 0,001	0,71	0,03	1,16
2007	< 0,001	1,39	0,10	1,29	< 0,001	1,37	0,73	1,02	< 0,001	0,70	< 0,001	1,22
2008	< 0,001	1,55	0,05	1,38	< 0,001	1,36	0,65	0,98	< 0,001	0,66	0,09	1,12
2009	< 0,001	1,56	0,01	1,49	< 0,001	1,47	0,83	0,99	< 0,001	0,65	0,49	1,05

One-year postoperative mortality for patients who underwent spinal surgery in 2008 was almost twice as high among patients undergoing fusions as in patients undergoing standard discectomy (Table 3). There were no statistically significant differences in mortality over the studied decade.

After 5 years of follow-up, 12% of patients with a surgery in 2000 had a second back operation. Standard discectomy showed the highest iterative surgery rate. The hospital length of stay significantly decreased over the studied decade. The median hospital length of stay for patients undergoing lumbar laminectomy was almost 50% shorter over the studied decade.

In 2008, 20,5% of the patients were unable to resume work one year after surgery. In comparing surgical interventions, we found spinal fusion leading to substantially lower rates of return to work in contrast to standard discectomy. Over a decade unadjusted outcomes with regard to return to work showed only improvement for ALIF and PLIF.

TABLE 3. ONE-YEAR OUTCOMES FOR PATIENTS UNDERGOING LUMBAR SPINE SURGERY IN 2000 AND 2008

	Lumbar laminectomy		Posterior interarticular fusion		ALIF		PLIF		Standard discectomy		Combined discectomy and fusion	
	2000	2008	2000	2008	2000	2008	2000	2008	2000	2008	2000	2008
1-year mortality (%)	1,6	1,5	0,0	2,5	1,1	0,5	1,4	0,9	0,4	0,6	1,0	0,8
1-year repeat surgery (%)	4,3	4,0	1,6	2,6	4,3	3,5	2,7	2,6	6,2	6,5	3,9	3,6
Unable to return to work 1 year after surgery (%)	30,4	31,2	47,8	48,9	30,2	22,7	35,8	26,1	15,0	14,4	30,8	30,6
Median length of stay (days)	9,0	6,0	8,0	8,0	8,0	6,0	8,0	7,0	6,0	4,0	9,0	6,0

Tables 4, 5 and 6 depict the results of a multiple logistic regression analysis of the presurgical variables on mortality, RTW and reiterative surgery. Mortality within one year after surgery was more likely in case of older age at the time of surgery, male gender, posterior interarticular fusion, combined discectomy and fusion and for patients who resided in Liege or Hainaut. Younger age, male gender and posterior articular fusion were statistically significant factors associated with iterative surgery. Reoperation was more likely for patients domiciled in Antwerp and East Flanders. Length of sick leave before surgery was the most important factor that correlated with poor work resumption. Older age, female gender, posterior interarticular fusion and combined discectomy and fusion were other significant factors associated with no return to work one year after surgery. Return to work was more likely after ALIF and standard discectomy. The significantly poorest RTW rates were observed in descending order in Hainaut (69,3%), Liege (73,3%) and West Flanders (78,9%). East Flanders (83,0%) and Antwerp (82,7%) enjoyed the best RTW rates. RTW rates were significantly higher in the second half of the observed decade.

TABLE 4. MULTIVARIATE LOGISTIC REGRESSION OF ITERATIVE SURGERY ONE YEAR AFTER SURGERY

Variable	*P* value	Adjusted OR (95% CI)
Age at time of surgery	< 0,001	0,99 (0,99-1,00)
Sex, female	0,002	1,12 (1,05-1,20)
Belgian province		
Antwerp (reference category)		1,00
Brabant	0,001	0,81 (0,72-0,92)
West Flanders	0,02	0,89 (0,80-0,98)
East Flanders	0,44	1,04 (0,94-1,16)
Hainaut	< 0,001	0,70 (0,58-0,83)
Liege	< 0,001	0,54 (0,44-0,66)
Limburg	0,001	0,81 (0,71-0,92)
Luxemburg	< 0,001	0,54 (0,40-0,73)
Namur	< 0,001	0,47 (0,36-0,62)
Index year		
2000 (reference category)		1,00
2001	0,73	1,03 (0,88-1,20)
2002	0,40	0,94 (0,80-1,09)
2003	0,95	1,00 (0,86-1,16)
2004	0,92	1,01 (0,87-1,17)
2005	0,88	1,01 (0,87-1,17)
2006	0,87	1,01 (0,87-1,17)
2007	0,82	0,98 (0,85-1,14)
2008	0,99	1,00 (0,87-1,16)
Intervention		
Lumbar laminectomy (reference category)		1,00
Posterior interarticular fusion	0,002	0,33 (0,16-0,66)
ALIF	< 0,001	0,69 (0,57-0,85)
PLIF	< 0,001	0,46 (0,37-0,56)
Standard discectomy	< 0,001	1,59 (1,39-1,68)
Combined discectomy and fusion	< 0,001	0,66 (0,55-0,81)

TABLE 5. MULTIVARIATE LOGISTIC REGRESSION OF MORTALITY ONE YEAR AFTER SURGERY

Variable	*P* value	Adjusted OR (95% CI)
Age at time of surgery	< 0,001	1,08 (1,07-1,09)
Sex, female	< 0,001	0,54 (0,46-0,62)
Belgian province		
Antwerp (reference category)		1,00
Brabant	0,64	1,06 (0,83-1,37)
West Flanders	0,10	0,83 (0,65-1,04)
East Flanders	0,68	0,96 (0,75-1,20)
Hainaut	0,02	1,45 (1,08-1,94)
Liege	0,03	0,59 (0,36-0,95)
Limburg	0,21	0,83 (0,61-1,12)
Luxemburg	0,68	1,10 (0,69-1,77)
Namur	0,11	0,64 (0,37-1,10)
Index year		
2000 (reference category)		1,00
2001	0,68	1,08 (0,75-1,54)
2002	0,41	1,16 (0,82-1,63)
2003	0,35	1,17 (0,84-1,64)
2004	0,36	1,17 (0,84-1,63)
2005	0,91	1,02 (0,73-1,43)
2006	0,13	0,76 (0,54-1,08)
2007	0,09	0,74 (0,52-1,04)
2008	0,26	0,83 (0,60-1,15)
Intervention		
Lumbar laminectomy (reference category)		1,00
Posterior interarticular fusion	0,01	1,92 (1,16-3,18)
ALIF	0,57	1,13 (0,75-1,69)
PLIF	0,54	1,09 (0,83-1,42)
Standard discectomy	< 0,001	0,55 (0,45-0,66)
Combined discectomy and fusion	0,43	0,88 (0,62-1,23)

TABLE 6. MULTIVARIATE LOGISTIC REGRESSION OF NO RETURN TO WORK ONE YEAR AFTER SURGERY

Variable	*P* value	Adjusted OR (95% CI)
Length of sick leave before surgery		
0-30 days (reference category)		1,00
30-90 days	< 0,001	1,89 (1,75-2,05)
> 90 days	< 0,001	4,32 (4,02-4,64)
Age at time of surgery	< 0,001	1,05 (1,04-1,05)
Sex, female	< 0,001	1,49 (1,40-1,58)
Belgian province		
Antwerp (reference category)		1,00
Brabant	0,24	0,94 (0,84-1,05)
West Flanders	< 0,001	1,16 (1,06-1,27)
East Flanders	0,99	1,00 (0,91-1,10)
Hainaut	< 0,001	1,52 (1,32-1,75)
Liege	0,04	1,20 (1,01-1,42)
Limburg	0,08	1,11 (0,99-1,25)
Luxemburg	0,05	1,29 (1,00-1,67)
Namur	0,20	1,14 (0,93-1,40)
Index year		
2000 (reference category)		1,00
2001	0,17	0,91 (0,79-1,04)
2002	0,21	0,92 (0,80-1,05)
2003	0,36	0,87 (0,76-0,99)
2004	< 0,001	0,78 (0,68-0,89)
2005	< 0,001	0,76 (0,67-0,87)
2006	< 0,001	0,83 (0,73-0,94)
2007	< 0,001	0,83 (0,73-0,94)
2008	< 0,001	0,82 (0,72-0,93)
Intervention		
Lumbar laminectomy (reference category)		1,00
Posterior interarticular fusion	< 0,001	1,87 (1,41-2,47)
ALIF	< 0,001	0,76 (0,67-0,86)
PLIF	0,94	1,01 (0,90-1,13)
Standard discectomy	< 0,001	0,48 (0,44-0,52)
Combined discectomy and fusion	0,44	1,05 (0,93-1,20)

Discussion

Overall, spinal surgery rates in Belgium have continued to rise gradually from 2001 through 2010. There was a sharp increase in laminectomy, combined discectomy and fusion, posterior interarticular fusion, ALIF and PLIF, despite lacking evidence of an increasing prevalence of spinal disease in the global population. Conversely, the proportion of standard discectomy remained fairly stable. These findings corroborate with the United States trends.[9, 20, 34] Previous research suggests that these changes were related, at least in part to technologic innovation and marketing. The Swedish Spine Register demonstrates the increasing trend in spinal stenosis surgery over the last 10 years, which is in line with the rise in decompressive laminectomy in Belgium.[31] Since 2000, the number of neurosurgeons per capita has substantially increased rising by nearly 51% (from 10,8 per 1.000.000 population in 2000 to 16,3 in 2010).[27] Orthopedist density grew at a rate of 18% over a decade, rising from 778 physicians per 1.000.000 population to 917. Health care systems like Belgium based on a fee-for-service payment model rather than on capitation or managed care may allow healthcare professionals to maximize healthcare claims and may further add to the rise in surgery rates.

This analysis documents important trends and provincial variations in the management of low back disorders in Belgium. Fusion rates are more variable than overall rates of spine surgery and crude spine surgery rates are the highest in the northern part of Belgium. Because all rates were standardized to the 2000 Sickness fund population, variations cannot be attributed to differences in age distributions or changes in population size. In comparison with orthopedic procedures, back surgery especially spinal fusion surgery varies substantially among geographic areas. It has been suggested that overall spine surgeon density, individual surgeons' backgrounds like age and spine surgery training or experience and patient factors including age, lifestyle, patient expectations, insurance status and overall health status contribute to this variation.[5, 6, 9, 17, 34, 37] These findings suggest a poor consensus on the appropriate

indications for spinal surgery and that surgery may be over- or underused in some areas. Additional reasons that explain regional variations in the number of spine surgery procedures are differences in coding and reporting. The influx of patients from abroad to some neighbouring Belgian provinces further contribute to the intra- and intercountry variations in spine surgery rates.[1] Variations by a factor of two or more across geographic areas are of clinical concern. It is hypothesized that differences in clinical philosophy between the northern and southern part of Belgium largely account for the variation in rates. Interpretation differences of available literature and inadequate dissemination of scientific information may further affect surgical approach. This opens perspectives for third party payers. Sickness funds may assist in clinician education in close cooperation with local opinion leaders by providing a performance feedback to increase compliance with beneficial low back pain therapies as outlined in the available guidelines.

Mortality rates were higher for fusion than for standard discectomy and increased steadily with older age. These findings are generally consistent with a review by Deyo et al.[9] Our overall mortality rated are comparable to those found by Street et al.[30] and in agreement with a systematic review of the literature reporting mortality rates for cervical spine and lumbar spine surgery <1%. In disagreement with Malter et al. [21] we demonstrated that fusion, especially PLIF, was associated with lower rates of iterative surgery than decompression alone. Reoperation rates after decompressive surgical procedures are reported to range from 6 to 23% and are well above our findings which corroborate fairly well with the range of repeat surgery after lumbar decompression for herniated disc (4,3 to 10,5%) reported by Martin et al.[22, 32] Median hospital length of stay for lumbar fusion in 2000 was higher than reported data from the U.S.[5, 8] However there was a significant declining trend in hospital stay for all surgical procedures.

Our analysis revealed a significant variation in RTW rate among patients who had decompression surgery, lumbar spinal fusion and standard discectomy. Claimants who underwent a less invasive

procedure with a shorter recovery period such as standard discectomy were more likely to return to work than patients undergoing fusions. Spinal fusion is a more complicated procedure because it involves bone grafting with or without internal fixation devices resulting in a larger dissection and a longer operating time.[16, 21, 23] Return to work status after standard discectomy was in line with the Spine Patient Outcomes Research Trial (SPORT) and substantially above the 64% return to work found by Veresciagina et al.[36, 38]

Multivariate analysis indicated that geographic region was an important factor associated with RTW following spine surgery. These results corroborate with the previously reported geographic region variations in outcome for lumbar spine surgeries.[5] Our data showed an interregional variety in spine surgery and return to work rates between the Dutch-speaking northern part of Belgium (Flanders) and the French-speaking southern part (Wallonia). These results are in line with a population-based survey on Belgian adults that clearly demonstrated that low back pain frequency, health beliefs, and socio-cultural factors influence health care behaviors and utilization in a society with equal access to high-quality medical care and under universal insurance coverage.[33] Moreover, our results suggest that higher rates of surgery are not necessarily worse and that the lowest surgical rates may be associated with worse average outcomes. Prior European research based on Spine Tango, the international spine registry of EuroSpine, the Spine Society of Europe reported one year good or excellent global outcome after surgery between 62% (patient-rated) and 80% (surgeon-rated).[18, 19, 29] Outcome was measured by the Core Outcome Measures Index (COMI) questionnaire consisting of validated questions covering the domains of pain, function, symptom-specific well-being, general quality of life, and social and work disability. Detailed information on work disability was not available. The Spine Tango shows an overall functional improvement of about 60% in all follow-ups equally distributed between Benelux, Scandinavia and German speaking groups.[13]

It is worth noting that sick leave before surgery proved to be a stronger variable associated with low RTW rates than the type of

spine surgery performed did. Den Boer et al. [7] found duration of sick leave a consistent predictor in a systematic review of bio-psychological risk factors for an unfavourable outcome after lumbar disc surgery. Long-term disabled claimants should be educated about their poor chances to resume work and be guided not to opt for surgery if professional reintegration is set as primary objective. In any way they need to be closely probed into the origins of the prior long-term disability before pursuing surgery.[6] Of particular note is the role of sickness funds in the secondary prevention of long-term work absence due to low back pain after the onset of symptoms. A randomized controlled trial showed that LBP patients who were provided information and advice by the medical advisers of the Alliance of Christian Sickness Funds experienced a significantly higher return to work rate due to a low relapse rate.[11] A practical screening tool to identify patients at risk of long-term sick leave may further enhance cost-effectiveness.[10] In case of severe relapsing low back pain despite conservative treatment and when surgery is perceived as an invaluable option, intervention needs to be performed without undue delay.[14, 15, 28]

Our investigation has important strengths and weaknesses. The Belgian social security system offers a unique opportunity to conduct population-based outcome analyses. Equal access to high-quality medical care and freedom of choice by both patients and providers are the basic principles of the Belgian compulsory health insurance. Approximately 42% of the entire Belgian population is legally insured through the Alliance of Christian Sickness Funds by free choice enrolment. Christian Sickness Fund coverage includes all provincial regions with a higher penetration rate in the northern part of Belgium (Flanders). The administrative claims data source is as such not subjected to participation or geographic bias. Mandatory sickness fund enrolment does not restrict freedom of choice of provider. Since all physicians are paid on a fee-for-service basis and the data set completely captures their activities and is consequently also representative for Belgian health care providers. Sickness fund claims provided data for all beneficiaries undergoing surgery and represent the types of care that the majority of low back pain patients

in Belgium likely receive and not just for selected patients or elite surgeons. However, the present retrospective study with administrative data did not allow us to identify the primary diagnoses, so that patients with serious comorbid conditions that could result in misleading rates or mortality were also included. For the same reason, we could not demonstrate the well-known deleterious effects of litigation and psychosocial factors on surgical outcome.

In sum, our univariate and multivariate analyses highlight the potential over- or underutilization of low back treatments in some provinces of Belgium. A more consistent approach to clinical care is called for by educating spine surgeons more uniformly. To date, information regarding variations in practice is not widespread in Belgium. As important stakeholder in health care, sickness funds have the legal and moral duty to present the results of large database analyses to health care providers. Administrative database feedback may provide impetus to peer-review current practice against evidence- and consensus- based clinical guidelines. We strongly believe that physician knowledge of local practice patterns and peer comparisons are imperative in reducing geographic variations and bridging local quality gaps while covered by a nationwide social security system.

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SECTION 2

NON-SPECIFIC LOW BACK PAIN

CHAPTER IV

PATIENTS AT RISK FOR LONG-TERM SICK LEAVE BECAUSE OF LOW BACK PAIN

M. Du Bois, M. Szpalski and P. Donceel (2009).

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"*The wise man sees in the misfortune of others what he should avoid.*"

(Marcus Aurelius, 121-180)

Abstract

Background context. Ten percent of patients with low back pain (LBP) is not able to resume work within 3 months of sick leave, accounting for 90% of all medical and indemnity costs.

Purpose. To quantify the relative contribution of socio-demographic, clinical, occupational, and psychological risk factors in determining the non-return to work after 3 months of compensated LBP and to develop a screening tool to identify patients who require further guidance and rehabilitation.

Study design/setting. A 6-month prospective cohort study of disabled workers applying for compensation benefit because of LBP during a 6-month period in the Belgian compulsory health insurance system.

Patient sample. Three hundred and forty-six patients.

Outcome measures. Patients unable to resume work within 3 months of sick leave were classified as bad outcomes.

Methods. Consecutively, injured workers applying for income replacement benefits between October 2003 and March 2004 because of LBP were followed 6 months after the start of the sick leave period. All subjects underwent a standardized physical examination and completed a battery of 12 self-report questionnaires.

Results. Forty-seven percent of the population had not resumed work 3 months after the start of the sick leave period. The risk factors for sickness absence more than 3 months were Oswestry disability index (odds ratio for each point increase: 1,04; 95% confidence interval: 1,02–1,06), fear of avoidance severity score (odds ratio for each point increase: 1,05; confidence interval: 1,02–1,09), blue collar worker (odds ratio: 2,18; confidence interval: 1,21–3,92), LBP for less than 12 weeks before sick leave (odds ratio: 0,32; confidence interval: 0,17–0,64), and pain behavior (odds ratio for each point increase: 1,72; confidence interval: 1,25–2,39). A multivariate screening test based on five questions identified 80% of the patients unable to

resume work after 3 months of sick leave (specificity: 56,6; cut off: 0,4).

Conclusions. A questionnaire comprising a limited set of items allows a practical screening of LBP patients unlikely to resume work.

Introduction

Back pain is a common health problem and a frequent cause of disability claims. An estimated 60% to 80% of people in the United States are affected at some time in their lives.[18, 32] In a Dutch study, 20% of low back pain (LBP) patients also reported sickness absence.[45] Each year in the UK nearly 120 million working days are lost because of back pain.[23]

The prognosis for most patients on sick leave to resume work is good.[44] Most of the treatment costs apply to the minority of patients (10%) who were not able to resume work after 3 months of sick leave. These claims account for 90% of all medical and indemnity costs attributable to LBP.[52]

Studies of the natural history of non-specific LBP are potentially compromised by the health care received and are also affected by data collection methods, with higher quality studies including independent follow-up for at least 12 months.[29, 60] Recent systematic reviews of the clinical course of LBP indicate that rapid improvements occur in the first 3 months post-onset, but that improvements are gradual thereafter.[26] Croft et al. recommend revising the view of recent-onset LBP as being self-limiting with only a small proportion that becomes persistent (> 12 weeks), to a model of LBP as an essentially persistent condition, characterized by frequent episodes of symptoms interspersed with periods of relative freedom from pain and activity limitation.[16]

The etiology of non-specific low back disorders is considered multifactorial, with a minor role for biomedical factors.[8] Prognostic factors for back pain disability have been elucidated by different reviews.[5, 9, 10, 62] Prolonged disability is not predicted simply by the severity of the injury, which is but one of a number of poorly understood determinants of chronic disability. The Boeing study has looked at a variety of factors which appear to predict delayed recovery.[46] The predictive factors tended to be psychosocial rather than medical. New Zealand has developed a set of evidence-based acute back pain guidelines for health professionals advocating a move

away from the medicalization of back pain. Complementary patient guides promote self-responsibility for episodes of back pain. One section of the guidelines emphasizes the importance of psychosocial risk factors in the disability associated with back pain.[28]

Numerous studies on factors of back disability studied the relations between the factors causing LBP and sick leave attributed to LBP.[31] Fragmentary research and use of a limited set of risk factors in many studies complicate a holistic scientific approach to disability management. Additionally, inconsistency on outcome measurement, selection techniques and the structure of the compensation system complicates comparisons of reported predictors in sick leave studies.[47] The applicability of results of clinical studies to medical decision making in a specific social security or income replacement context might be limited.

Early return to useful and productive activity has been shown to decrease both disability and self-reported pain.[2] According to several guidelines, resuming normal activities and not pain relief is the primary goal in the rehabilitation of patients with chronic LBP.[1, 41] To achieve this goal, an interdisciplinary evaluation and an intensive active treatment are recommended.[66]. The intensity of any treatment is strongly depending on the patient's conscious motivation to perform optimally during the evaluation and rehabilitation process.[37]

There is a general agreement that patients with LBP should be encouraged and supported to remain at work or to undergo an early gradual return to work with modified duties.[14, 53] Rehabilitation management should therefore identify, as early as possible, those patients at high risk of persistent disabling symptoms.[22, 35]

The holistic impact of known bio-psycho-social factors at baseline on return to work needs to be studied in a standardized way. An investigation in a compulsory national health insurance setting is able to minimize confounding by compensation.

The purpose of this study was to determine the extent to which worker characteristics including worker's demographics, and clinical manifestation of LBP, work and workplace factors, and psychological features are useful in identifying claimants at higher risk of long-term incapacity versus those likely to return to work in a compulsory national health insurance setting. The second aim was to identify a limited set of screening questions for long-term sick leave in patients with LBP.

Methods

A prospective cohort was consecutively recruited from disabled workers applying for compensation benefit because of LBP during a 6-month period beginning on October 1, 2003 at the Alliance of Christian Sickness Funds.

All employees were subjected to the Belgian compulsory health insurance system. The Belgian compulsory scheme includes both health insurance coverage and income support in the event of illness and is administered by five private non-profit organizations called sickness funds. Membership of a sickness fund is compulsory, but the choice of sickness fund is free. The Alliance of Christian Sickness Funds is the largest of those sickness funds covering approximately 45% of the mandatory insured Belgian population. Approximately 66% of the insured population are blue collar workers of whom 20% end up filing for disability payment. An application for benefits always implies a certificate of work incapacity by a physician including diagnosis. Claim assessment and follow-up evaluation is made by the medical adviser. The patient is entitled to sickness benefit if he ceased all activities because of a reduction of earning capacity of at least 66%.

In Belgium, disability is defined as the inability to earn one third or less by doing one's previous job or any other job that corresponded to one's education and capabilities and that does not entail a significant decline in social status. This definition recognizes that work provides

both income and social status. There is no list of severe medical conditions that automatically mean that a patient is disabled and there is no maximum monthly earned income to qualify. Sickness allowance begins after the guaranteed salary period paid by the employer: 2 weeks of disability for blue collar workers and 1 month of disability for white-collar workers. Benefit amount depends on the lost income, the duration of disability and the social situation of the claimant. In general, benefits range between 40% and 65% of the previous income.

In contrast, the Social Security Disability Insurance of the United States operationalized disability as an inability to engage in any substantial gainful activity because of any medically determinable physical or mental impairment(s) which can be expected to result in death or which has lasted or can be expected to last for a continuous period of not less than 12 months. In addition to being unable to perform his or her previous work, the person cannot, considering age, education, and work experience, engage in any other kind of substantial gainful activity that exists in the US economy. To qualify, an individual's monthly earned income must be less than $940. The Social Security Disability Insurance maintains a list of medical conditions that are so severe that they automatically mean that a LBP patient is disabled. Some back conditions that appear on this list are stenosis, degenerative disc disease, lumbar back pain with positive straight leg raising tests, and nerve root compression. If the back condition is not on the list, Social Security Disability Insurance decides if it is of equal severity to a medical condition that is on the list or if the back pain interferes with patient's ability to do the work he or she did previously. The first Social Security benefit will be paid for the sixth full month after the date the disability began.

Because all employees are subjected to the Belgian compulsory health insurance system, a control group of patients who were not applying for benefits could not be included.

The medical advisor of the sickness fund is entitled to request additional medical or other information from the claimant to make an

informed claim decision. The claimant is obliged to cooperate by providing information or documents in his or her possession and by otherwise participating in the claim investigation such as attendance at an independent medical examination by the medical adviser. The processing of personal medical data anonymously in an administrative database required a written informed consent by law. Under current law, every claimant can spontaneously resume activity without consulting the medical advisor beforehand. An imposed return to work by the medical advisor if any must legally be confirmed in writing.

Study participants were claimants fulfilling the following admission requirements:

- low back pain defined as pain located between the lower rib cage and the buttocks. This pain may extend down to the lower limb in combination with neurological signs;
- low back pain is not caused by any of serious spinal conditions, such as *cauda equina*, spinal stenosis, fracture, cancer, and infection. Low back pain cases due to a disc herniation were included. Underlying facet arthropathy was not excluded;
- no low back surgery scheduled at the time of claim introduction;
- sufficient understanding of either Dutch or French was needed to fill out the questionnaires.

A visit to the social security physician was scheduled within 4 to 6 weeks after the beginning of sick leave. During the first visit, a physical examination was performed according to a standardized protocol. The physical examination included the following: measurement of height and weight, standing and walking measurements, kneeling and sitting measurements, and supine measurements.

Standing and walking measurements included spine flexion graded as no limitation (maximum is near or at toes), mildly or severely limited (maximum is just past or above knees), spine extension (recorded as

can hold 30 seconds. without pain or can't hold), Romberg (classified into no loss of balance or increased swaying or loss of balance), wide-based gait (recorded as definitely present or definitely not present), and foot plantar flexion weakness (classified as normal [one lift or more] or limited [cannot lift up]). Kneeling and sitting measurements encompassed ankle reflexes (recorded as normal, less than normal, or absent), foot dorsiflexion weakness and great toe dorsiflexion weakness (both graded as intact or not intact). Supine measurements include straight leg raising and crossed straight leg raising. A straight leg raising was considered positive if symptoms such as pain, numbness, or tingling radiating below the knee occurred when the leg was at or below 60° of elevation as measured by a goniometer.

Finally, Waddell et al.'s nonorganic signs [63] were identified and the behavioral responses to pain were scored according to the UAB (University of Alabama at Birmingham) Pain Behavior Scale.[48] Low back pain was classified according to four different pain patterns (Table 2).

The social security physician used a standard protocol including questions on items that according to the scientific literature appear to be risk factors for long-term disability including age, gender, daily smoking, legal job classification (white-collar employee or a blue collar worker, depending on mainly intellectual or manual work), litigation related to low back pain, low back pain symptom duration (acute, subacute, chronic according to the Cochrane Back Review Group (CBRG) criteria, recurrent low back pain was not considered), previous sick leave because of low back pain, history of prior low back surgery, nature of the injury and imaging. Comorbidity was measured by the presence or absence of 34 medical conditions and mainly based on the Charlson Comorbidity Index and the Chronic Disease Score.[11, 61]

There is a potential bias by no blinding in the evaluation of disability at 3 months by the medical advisor who examined the patient initially. That source of bias was avoided by instructing the medical advisors only to observe the return-to-work status as outcome of a

natural history of sick leave. Medical advisors were asked not to drive disability by issuing return-to-work orders.

1. Questionnaires

Patients filled out a series of 12 structured questionnaires and open-ended questions addressing items related to low back pain disability based on the international literature or expert opinion. All questionnaires were translated into Dutch and French with allowances for figures of speech. Revised drafts of the questionnaires were field tested by low back pain patient representatives and subsequently modified by faculty members. Questionnaires were filled out during the first visit. The medical adviser was present to explain the purpose of the research and to answer questions when the claimants were filling out the questionnaires. The battery of the 12 self-administered questionnaires took 30 to 45 minutes to complete. Given that personal interviews usually last 50 to 90 minutes and telephone interviews typically last 30 to 60 minutes, we found these times to be acceptable. Because the questionnaires included no prior hypotheses and expected answers, there was no ground for a respondent's learning bias. We did therefore not randomize the order of the questionnaires.

The self-report questionnaires included the Orebro Musculoskeletal Pain Questionnaire (OMSPQ) [33, 34] Oswestry low back pain Questionnaire version 2.0 (OLOW BACK PAINQ) [17], Zung Self-Rating Depression Scale [67], Modified Somatic Perception Questionnaire (MSPQ) [38], Multidimensional Pain Inventory [30], Fear-Avoidance Beliefs Questionnaire [64], Pain Catastrophizing Scale [43], Tampa Scale of Kinesiophobia (TSK) [58], Job Content Questionnaire (JCQ) [27], Job Description Questionnaire (JDQ) [53], Positive and Negative Affect Scale (PANAS) [13], and the Perceived Stress Scale (PSS).[15] The perceived physical work load was registered according to the Borg Rating of Perceived Exertion (RPE) [7].

2. Outcome

Time to return to the same or any other job (return to work) was the primary outcome measure. Sick leave was defined as the period of time an employee is absent from work with full pay as a result of a disabling injury or illness and is seeking appropriate medical treatment. Return to work was defined as return to full-time activity. There was no imposed return to work because medical advisors were asked not to drive disability by issuing return-to-work orders.

3. Statistical analyses

Non-return to work within 3 months of sickness absence was the dependent variable. The data for the outcome variable were analysed using four distinct statistical procedures. First, relationships between the outcome measure and the various predictor variables (patient characteristics, clinical tests, structured questionnaire sum scores) were investigated by nonparametric univariate analyses. Second, forward stepwise logistic regression was conducted to discover the combinations of variables that might be associated with the outcome measure. New independent variables were added to the model if they met $p < 0,05$ as significance criterion for inclusion. Third, non-stepwise multivariate logistic regression analysis was performed separately within each of the 12 structured questionnaires to identify significant items predictive for the return-to-work status. Fourth, the significant questions of all 12 analyses were combined in an overall logistic regression as the basis for screening. Similar worded questions were cross-checked by detecting multicollinearity in the separate and final logistic regression analyses.

The level of cut-off points for the screening tool was chosen to provide a sensitivity of at least 80% and a specificity of at least 50% both to identifying patients with low back pain at risk for prolonged work absence. All analyses were conducted using the statistical application SPSS 14.0. (Chicago, IL). Unless stated otherwise, the level of statistical significance was set at 0,05 to minimize type-1 errors.

Results

Patients entered the study between October, 31, 2003 and March, 31, 2004. No participants in this follow-up study declined consent for the use of personal medical data or switched to another sickness fund. Consequently, there was no loss to follow-up. Of 390 patients meeting study inclusion criteria, 346 (89%) had complete data on the predictor variables of interest and were included in subsequent analyses. Eleven percent had one or more incomplete questionnaires. There was no difference in age, gender, daily smoking, job classification, litigation, low back symptom duration, previous sick leave because of low back pain, and history of prior surgery between patients with incomplete and complete questionnaires. The mean age of the 346 patients was 41 years. Fifty-three percent of the enrolled subjects were male and 74% were blue-collar worker. Table 1 shows the frequency of the different diagnostic categories. Ninety-eight patients (28%) generally had a lengthy history of low back pain, with a duration of more than 12 weeks. A significant majority of patients (81%) used analgesics. In 50% of patients, a variety of imaging had been performed. One hundred and twenty-five patients (30%) were on extended periods of home bed rest (> 1 h/d) and about 39% reported experiencing low back pain for the first time. Smoking was reported in 39% of the disabled workers. There was no trend in comorbidity. Associated disease related mostly to cardiovascular disorders (e.g. hypertension) and specific surgery (e.g. cholecystectomy, eye surgery, or hysterectomy). The prevalence of comorbidity was 20%. A minority of the patients (6%) had previous surgery for low back disorders.

TABLE 1. FREQUENCY OF PAIN PATTERN CHARACTERISTICS AT THE FIRST VISIT TO THE SOCIAL SECURITY PHYSICIAN

Pain patern	Frequency
LBP without radiation below the inferior gluteal fold	42
LBP with radiation limited to areas above the knee, without neurologic signs	31
LBP without radiation extending to areas below the knee, without neurologic signs	23
LBP with radiation extending to areas below the knee, with neurologic signs	4

The frequencies of positive findings for the physical examination measures are displayed in Table 2 on the next page.

TABLE 2. FREQUENCY (%) AND MEDIAN (RANGE) OF CLINICAL TESTS PERFORMED AT FIRST EXAMINATION (SICK LEAVE OF 4 TO 6 WEEKS)

Clinical test	N	%	Odds ratio	*P* value
Antalgic posture	58	17	1,85	0,03
Limited lumbar flexion	31	9	2,98	< 0,01
Limited lumbar extension	290	67	1,30	0,06
Romberg sign	5	1	4,53	0,18
Disturbed gait	50	15	2,87	< 0,01
Unable to toe walk L	35	10	1,53	0,06
Unable to toe walk R	39	12	2,70	< 0,01
Absent ankle reflex L	1	0	0,33	0,90
Absent ankle reflex R	59	17	1,44	0,07
Loss of knee reflex L	59	17	1,99	0,18
Loss of knee reflex R	45	13	1,44	0,15
No intact ankle dorsiflexion L	58	17	1,53	0,06
No intact ankle dorsiflexion R	31	9	1,74	0,11
No intact first toe dorsiflexion L	63	18	1,37	0,10
No intact first toe dorsiflexion L	33	10	1,43	0,27
Straight Leg Raising Test positive	84	25	2,33	< 0,01
Non-organic signs > 3	31	9	1,82	0,30
Trophic skin disorder	13	4	0,34	0,06
Leaving the table without pain	87	25	1,94	< 0,01
Body mass index, median (range)	25,03 (17-45)		0,97	0,55
Pain behavior observation scale, median (range)	0,3 (0-4,5)		1,7	< 0,01

Univariate crude odds ratios and P values are displayed for each clinical predictor for sick leave longer than 3 months.

Limited lumbar extension was the most common positive test, followed by positive straight leg raising test, abnormal reflexes, and antalgic posture. Median Pain Behavior Scale score was 0,5. The scores for the various structured questionnaires at the time of the first visit to the social security physician are displayed in Table 3.

TABLE 3. MEDIAN AND RANGE OF THE SCORES FOR THE QUESTIONNAIRES COMPLETED AT FIRST EXAMINATION (SICK LEAVE OF 4 TO 6 WEEKS)

Questionnaire	Median	Range	Odds ratio	*P* value
OMSPQ	119	69-182	1,03	< 0,01
Oswestry	38	0-76	1,04	< 0,01
Zung	41	0-68	1,04	< 0,01
MSPQ	7	0-27	1,06	< 0,01
MPI – influence	3	0-11	1,68	< 0,01
MPI – support	5	0-26	0,90	0,07
MPI – severity	4	0-6	1,40	< 0,01
MPI – control	3	0-36	1,20	< 0,01
MPI – affectivity	3	0-6	1,20	< 0,01
FABQ – work	29	0-42	1,05	< 0,01
FABQ – Fys	19	0-84	1,08	< 0,01
PCS – rumination	10	0-10	1,08	< 0,01
PCS – magnification	5	0-12	1,11	< 0,01
PCS – helplessness	11	0-37	1,08	< 0,01
TSK	43	0-68	1,05	< 0,01
Borg	5	0-10	1,05	0,32
PANAS – Pos	33	0-50	1,05	< 0,01
PANAS – Neg	19	0-117	1,01	0,31
PSS	17	1-37	1,04	< 0,01
JCQ – JD	11	9-20	1,09	< 0,01

OMSPQ = Orebro Musculoskeletal Pain Questionnaire; Oswestry = Oswestry Disability Questionnaire version 2.0 ; Zung= Zung Self-Rating Depression Scale; MSPQ = Modified Somatic Perception Questionnaire; MPI = Multidimensional Pain Inventory; FABQ = Fear-Avoidance Beliefs Questionnaire; PCS = Pain Catastrophizing Scale; TSK = Tampa Scale of Kinesiophobia; Borg = Borg Rating of Perceived Exertion (Borg); PANAS = Positive and Negative Affect Scale; PSS = Perceived Stress Scale; JCQ – JD = Job Content Questionnaire – job description

Univariate crude odds ratios and p values are displayed for each questionnaire score predicting sick leave for longer than 3 months. Odds ratios indicate the increase in terms of percentage in the odds associated with a one-point increase in the scores.

The percentage of participants who were still unable to resume work was 90% at 4 weeks with a subsequent decrease to 62% at 2 months after the start of sick leave. The median time off work because of low back pain was 84 days. Those returning to work always resumed full work activity. No subjects filed a new back claim within the follow-up period.

Univariate statistics of risk factors for long-term disability are shown in Tables 2-4.

TABLE 4. FREQUENCY (%) AND MEDIAN (RANGE) OF PATIENT CHARACTERISTICS

Characteristic	N	%	Odds ratio	*P* value
Blue-collar worker	256	74	2,27	< 0,01
Work-related accident	7	2	2,46	1,00
First periode	136	39	0,98	0,92
Smoking	135	39	1,22	0,38
Stuck in bed > 1 h	125	30	1,23	0,11
Painkillers	280	81	0,89	0,58
Symptoms > 12 wk	98	28	2,10	< 0,01
Previous surgery for LBP	22	6	1,57	0,06
Imaging: new compression confirmed	42	12	4,20	0,02
Imaging planned	75	22	2,38	< 0,01
Comorbidity	67	20	0,98	0,77
Radiating pain	197	57	1,46	< 0,01
Age, median (range)	41 (18-64)		1,01	0,26

Univariate crude odds ratios and P values are displayed for each clinical predictor for sick leave longer than 3 months.

After adjustment for confounding factors in a stepwise logistic regression, five variables were significantly associated with no return to work. To address the concern of the validity of the selected questions, we used ordinary least square regression for each

questionnaire and for the five retained questions. All calculated variance inflation factor values were below 2.5. The most significant predictor of a poor outcome was a high Oswestry Disability Index. It was associated with a 4% increase in odds of a poor outcome per additional point increase (odds ratio: 1.04; confidence interval: 1.02–1.06). Other risk factors included fear of avoidance severity score (odds ratio per point increase: 1.05; confidence interval: 1.02–1.09), blue-collar worker (odds ratio: 2.18; confidence interval: 1.21–3.92), low back pain for less than 12 weeks before going on sick leave (odds ratio: 0.32; confidence interval: 0.17–0.64), and pain behavior (odds ratio per point increase: 1.72; confidence interval: 1.25–2.39).

Screening individuals prone to long-term disability has to be practically feasible for both the social security physician and the patient. It was crucial therefore to aim for a limited set of questions from the used questionnaires instead of sum scores. Significant items of each questionnaire were a candidate variable for an overall stepwise logistic regression model. Overall logistic regression analysis showed that five questions were significantly associated with no return to work:

- Do you expect to return to work within 6 months? (OMSPQ)
- To what extent does the pain interfere in your daily activities? (MPI)
- It is not advisable to be physically active? (TSK)
- Do you feel generally nervous? (PANAS)
- Do you feel generally scared? (PANAS)

Together, these five questions correctly classified the poor outcome of 62% of the claimants with a higher positive predictive value (71%) than negative predictive value (38%) at a cut-off value of 0.5. The overall correct classification percentage was 67%. Table 5 lists the questions that were statistically significant for the logistic regression model of returned to work or not returned to work within 3 months after sick listing. The total variance explained by the model was 25%.

A cut-off value of 0.4 was chosen as the optimal cut off, as it provided good sensitivity (0,80) and a specificity of 0,57 both to identifying patients with low back pain at risk for prolonged work absence. Lower threshold cut offs resulted in an increase of sensitivity without an appreciable loss in specificity. By using this 0.4 cut-off, 8 out of 10 people with a long lasting disability would be correctly identified by the screening model, whereas 6 out of 10 of those who did return to work would be successfully screened out.

TABLE 5. LOGISTIC REGRESSION MODEL COMPRISING FIVE SCREENING QUESTIONS WITH BINARY RESPONSE OUTCOME OF SICK LEAVE

Variable	Sick leave > 3 months	Adjusted odds ratio (95% CI)
Do you expect to return to work within 6 months? (OMSPQ)	1,14	1,04-1,25
To what extent does the pain interfere in your daily activities? (MPI)	1,57	1,27-1,94
It is not advisable to be physically active? (TSK)	1,39	1,10-1,76
Do you feel generally nervous? (PANAS)	0,61	0,48-0,78
Do you feel generally scared? (PANAS)	1,44	1,10-1,89

OMSPQ, Orebro Musuloskeletal Pain Questionnaire; MPI, Multidimensional Pain Inventory; TSK, Tampa Scale of Kinesiophobia; PANAS, Positive and Negative Affect Scale.

Estimates are adjusted for all other variables in this table.

Discussion

The main target population of this study was workers claiming income replacement from social security for work disability because of low back pain. Musculoskeletal disorders are the second leading cause of disability in Belgium after mental disorders.[49] Prevention

of work disability is therefore a key objective in any low back control program and priority should be given to studies on risk factors for long-term disability.[6, 42]

Return to work is an important outcome used frequently in prospective studies within compensation contexts. Many studies demonstrate that most of the patients with work-related low back pain are able to return to work within 4 to 8 weeks after the onset of pain.[54, 65]

The present study attempted to demonstrate the correlation between several risk factors and return to work. The study has the advantage of using previously validated questionnaires. To our knowledge, this is the first study within a workers' compensation population where 12 standardized questionnaires were used. Because all claimants are legally obliged to follow the instructions of the social security physician while on benefit, the rate of participation was 100%.

Subjects were compelled by law to participate in claim assessment. There are no legal dispositions about the claim assessment process that enable us to temporarily include questionnaires for this study. The present study fits in the legal duty of sickness funds to optimize the social security system. A potential bias of the accuracy related to self-reported questionnaires must be offset by the resulting absence of volunteer bias because of implied coercion by law.

In our study, 47% of the patients had not resumed work 3 months after start of sick leave. These results do not conflict with the 80% return-to-work rates reported in literature because in our study, claimants were sick listed for 6 weeks at the time of enrolment in the study.[25, 40, 56] According to the three-phase model of back pain, 40% of patients were still off work at 6 weeks. After 3 months of sick leave approximately 50% of these patients were still unable to resume work. Data from Cheadle and others strongly suggest that disability prevention opportunities are substantially less likely to help the worker after 3 months of lost time from work after injury.[12] Consequently, early (3 months) non–return-to-work status represents

a significant marker of functional outcome in the current study of potential impediments to return to work after LBP.

Bed rest has been shown to be an ineffective treatment for non-specific LBP. Our results showed that 30% of subjects were on extended bed rest indicating that care for LBP was well below standard. Verbunt et al. found that 33% of Dutch patients with (sub)acute LBP still rely on bed rest, especially during a new episode of pain.[57]

This study aimed to identify predictive factors for disability after 3 months in patients sick listed for LBP in a social security setting. Oswestry Disability Index, fear of avoidance severity score, LBP for more than 12 weeks before sick leave, blue-collar worker, and pain behavior were found as predictive factors. Several authors have suggested that elevated fear-avoidance beliefs are a precursor to prolonged disability.[36] In patients receiving physical therapy for work-related, acute LBP, Fritz et al. found that higher fear-avoidance beliefs predicted continued disability and prolonged work absence, even after controlling for initial pain and disability.[20] In a recent review article, Vlaeyen and Linton found pain-related fear and avoidance to be an essential feature of the development of a chronic problem.[59] Pain behavior is another factor which has been related to return to work in previous studies.[55] There is conflicting evidence about the role of prior history of LBP on disability duration. McGill et al. found that having a history of LBP is associated with changes in attitudes, in body composition, and in the way people move, load their backs, and respond to a variety of motor and stability challenges.[39] A systematic review by Steenstra et al. on the prognostic factors for duration of sick leave in patients sick listed with acute LBP revealed that a history of LBP did not influence duration of sick leave. The importance of the Oswestry Disability Index on long-term sick leave was supported by other studies. Seferlis found that a high Oswestry Disability Index assessed at study entry was the only factor that predicted chronicity after one year in 180 patients who required sick leave for acute LBP.[51] Fransen et al.

concluded that Oswestry Disability Index was associated with the transition from acute to chronic occupational back pain.[19]

Medical advisers are in a unique position to identify patients with potential long-term disability and intervene when appropriate. Screening, the process by which medical advisers can identify at-risk claimants, can be followed by one-time or repeated short counseling sessions, known as brief interventions, which are designed to help the LBP patients overcome their disability.

The initial battery of standardized questionnaires was shortened to a five-item screening tool. Similarity, worded questions were cross-checked by detecting multicollinearity in the separate and final logistic regression analyses. There were no items that were found to be ambiguously phrased and those that could only be answered by specific groups. There were also no items with small rating score distributions. The short screening tool reduced the administration time from 45 minutes to less than 5 minutes, enabling it to be used in social security and medical settings with minimal disruption to treatment time.

A screening tool built on five questions is easy to use and seems to be predictive for long-term disability. The questions relate to patients own prediction, negative affect, fear of avoidance and comorbid pain. The significance of patient's own prediction on return to work was in agreement with the findings of Sandstrom and Esbjornsson.[50] The patients predicted the outcome correctly in 69%, with a sensitivity of 68% and a specificity of 71%. The importance of negative affect on disability is consistent with the prospective analysis of Boersma and Linton who concluded that expectancy, negative affect, and fear-avoidance beliefs are interrelated constructs that have predictive value for future pain and disability.[3, 4] Finally, fear of avoidance beliefs may be instrumental in the transformation of acute pain into chronic pain, leading to functional disability and subsequent deconditioning.[24]

Limitations of this study include self-reported health status on the standardized questionnaires. The use of a not standardized translation

model may have been another potential source of bias. The degree to which the data are inaccurate because of reporting error is unknown. To be included in this study, patients had to suffer from LBP not caused by any of several red flags such as *cauda equina*, fracture, cancer, infection, and without low back surgery scheduled at the time of claim introduction.

Therefore, the results of this study are not applicable to patients suffering from specific LBP or where surgery for low back is scheduled. Our study population consists of workers from a wide variety of occupational settings, fully covered by social security and representative for the Belgian population. This makes our results more widely generalizable than a selective sample of workers from a specific industry or region. Additional large longitudinal studies of sufficiently large size among sick-listed employees with LBP are needed to confirm our results. The study was performed in the Belgian compulsory health insurance system, including both health insurance coverage and benefits. The risk factors should therefore not be automatically applicable to other systems of compensation until it has consistently demonstrated adequate calibration. This advice may apply to the United States because the first Social Security benefit will be paid only from the sixth month after the onset of disability. However, research by Gallagher et al. suggests that our conclusions are likely applicable to individuals applying for Social Security disability benefits because of LBP.[21] They examined the contribution of baseline compensation status, seeking a lawyer's help and receipt of compensation during a 6-month period to return to work at follow-up in a US LBP population. Neither compensation status nor involvement with a lawyer influenced the prediction of return-to-work outcome but increased the likelihood of return to work for groups of individuals at higher risk such as those with external locus of control. Because the sample was drawn from a non-industrial primarily rural state, generalizing these findings to other settings must be done with caution.

Our predictive instrument was derived from patients suffering from LBP who were already sick-listed for 4–6 weeks at baseline and may

not readily apply to patients with similar complaints applying for disability allowances at onset. Furthermore, our study did include patients with poor language skills. These affect especially immigrants. The predictive power of our model therefore needs further evaluation when applied to this group. Finally, evaluating the validity of the screening tool in a prospective study design is warranted.

If medical advisers are to accept and use a screening instrument to identify patients at risk for long-term sick leave, the instrument must not only be sensitive to detect a high number of patients at risk for long-term disability and specific to allow for the cost of screening but also brief and easy to use and score. In a future cohort study, we attempt to pilot the screening tool, refine, and validate it.

Conclusion

This population-based study in a compulsory health-care system used a large set of bio-psycho-social prognostic indicators for return to work in low back claimants, including medical history, physical examination, and 12 standardized questionnaires. In the first weeks of work disability return to work could be adequately predicted by a set of five questions including patient's own prediction, pain interference, fear of avoidance, and affect.

The early and rapid identification of LBP patients at high risk for chronic disability by a short screening tool can be very helpful in the medical assessment of work disability. Because all factors are potentially modifiable, they offer promising targets for rehabilitation and return-to-work guidance.

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CHAPTER V

A SCREENING QUESTIONNAIRE TO PREDICT NO RETURN TO WORK WITHIN 3 MONTHS FOR LOW BACK PAIN CLAIMANTS

M. Du Bois and P. Donceel (2008).

Eur Spine J, 17: p. 380-385.

"*Study prophecies when they are become histories.*"

(Sir Thomas Browne, 1605-1682)

Abstract

The objective of the present study was to develop a short prediction questionnaire for estimating the risk of no return to work (RTW) within 3 months of sick leave to facilitate triage and management of a patient population of subacute low back pain (LBP) sufferers.

We conducted a prospective study with a 3-month follow-up on 186 patients with LBP introducing a claim for sickness benefits to the largest sickness fund in Belgium. Patients completed a screening questionnaire within 2 weeks after claim submission. All patients were invited for clinical assessment, at 6-8 weeks of sick leave, by the medical adviser. Patients' work status was recorded by the sickness fund.

About 20% of the patients did not resume work at 3 months' sick leave. They were more likely to experience pain below the knee, to have an own previous prediction of a 100% no RTW and to have a severe interference of pain on daily activities. The screening tool based on these three items correctly classified 73,7% of the non-resumers and 78,4% of the resumers at a cut-off score of 0,22. The findings of this study provide evidence of the utility of a short screening questionnaire for future use in intervention studies in a social security setting.

Introduction

Although episodes of acute low back pain (LBP) are mostly short-lived and 80% of attacks of LBP recover in about 6 weeks, back complaints still constitute the second most common symptom after upper respiratory complaints.[22] Disability and early retirement from back pain places a significant socioeconomic burden on the individual and the community and are rising exponentially.[15] Most of the costs linked to the treatment of back pain apply to a small proportion of sufferers experiencing persistent symptoms leading to disability.[5, 25]

Obstacles to recovery and return to work (RTW) usually fall under the categories red and yellow flags.[10, 20] Persistent disabling symptoms may be prevented by early identification and modification of psychosocial factors that have been shown to be effective when implemented early in the course of back pain and play even an important role in the transition from acute to chronic LBP.[9] Maladaptive attitudes and beliefs concerning back pain, particularly fear-avoidance beliefs, pain-coping strategies, reinforcement of pain behaviours by family members, and job dissatisfaction are important issues to consider when treating patients with back pain.[21]

Multiple questionnaires are available for the assessment of LBP and disability, but only some address the problem of predicting which patients with LBP will develop long-term incapacity.[6, 8, 20] Most of these questionnaires have been set in the workplace or a primary care setting and require a long period for completion.[7] They mainly focus on administrative or clinical predictors, whereas back pain is a multidimensional health problem. A systematic review of the literature on prognostic factors for duration of sick leave for patients with acute LBP identified promising factors like expectations of workers, general health, job characteristics, attorney involvement, continuity of care, body mass index, lack of energy, life events and quality of management of LBP in occupational care.[23]

In a former study, we identified a small number of important risk factors at 6 weeks of sick leave in a LBP population to predict no RTW at 3 months. Further investigations in other patient samples are needed to confirm the reliability and validity of a screening tool based on these prognosticators.

The present study aims to establish a screening questionnaire that would accurately assess LBP claimants who were not likely to resume work over a 3-month period of sick leave. Such a screening tool has to be practical to administer and not burdensome to medical advisers in identifying risk patients who need more intensive education, management and follow-up.

Materials and methods

1. Population

In Belgium, the compulsory social health insurance covers the entire population. When an employee becomes disabled, the first 2–4 weeks of work incapacity are paid by the employer. If work incapacity continues, the patient applies for a social security benefit by sending a medical certificate of the treating physician to the medical adviser of the sickness fund. Claim assessment, follow-up evaluation and the decision about benefit entitlement are done by the medical adviser. There is no time limit for coverage. Participants consisted of 186 patients entitled to sickness allowance by the Alliance of Christian Sickness Funds because of LBP. Patients with a certified diagnosis of lumbago, disc hernia or dorsal pains were identified by the medical adviser of the sickness fund. Patients suffering from LBP with neurological progression, infection, fracture, tumour or inflammation were excluded. Claims related to surgical operation for LBP were not entertained either.

2. Screening questionnaire

The questionnaire consisted of eight areas of medical and psychological functioning that are potential correlates of outcome.

These areas included location of LBP, duration of symptoms, patient's own prediction, interference of pain on daily activities, patient's opinion about physical activity and perceived nervousness and anxiety. We identified eight screening questions from standardized questionnaires and included the Oswestry Disability Scale.

3. Design

The selected patients were sent the screening questionnaire. They were asked to fill out the questionnaire and to send it back to the medical adviser. Approximately 4-6 weeks after claim introduction, patients were invited by letter to the medical adviser's office for disability assessment unless they had in the meantime resumed working activities.

4. Outcome

A good outcome was defined as return to the previous occupational level at 3 months after the first day of sick leave. All other cases were classified in the no RTW group.

5. Analyses

Results were analysed using SPSS Version 15.0 (Chicago, Illinois). $P < 0,05$ were considered statistically significant. Logistic regression, applied because the length of follow-up was equal for all subjects and the outcome binary, was chosen for its ability to provide more accurate estimates when both continuous and categorical variables are used. Univariate logistic regression analysis was used to explore the association of the result to each question with the RTW status at the 3-month follow-up. Questions with more than two response categories were dichotomized using the cut-off point with both optimum sensitivity and specificity. Multiple logistic regression was used to identify factors independently associated with the RTW status at 3 months follow-up. All questions and Oswestry Disability Index were entered; non-significant variables were removed stepwise until all remaining variables had a significance of $P < 0,05$.

Receiver operating characteristic (ROC) curve was calculated to show the sensitivity and specificity of the screening tool.

Results

1. Subjects

We attained a 100% unit and item response. There were no missing data. The LBP diagnosis of the treating physician was confirmed by the medical adviser in all cases. The final sample consisted of 186 claimants, 110 males and 76 females with a mean age of 42,5 years (SD ± 10,55). About 26,3% of the patients suffering from LBP had also pain below the knee. About 30.1% of the patients reported more than 12 weeks of LBP.

2. Return to work

About 20,4% claimants did not resume work at 3 months follow-up. About 27,6% of the female claimants were not able to RTW within 3 months versus 15,5% of the male patients (P = 0,043). The resumers and non-resumers did not significantly differ by age (P = 0,860).

3. Predictors

Table 1 shows the univariate associations of the nine questions with the RTW status.

The logistic regression analysis yielded a model with three variables, which provided a good fit to the data (Hosmer and Lemeshow Test χ^2 [four df] = 6,025, P = 0,197).

TABLE 1. VARIABLES RELATED TO RETURN TO WORK STATUS ASSESSED BY Χ²-TESTS: UNIVARIATE COMPARISONS

Variable	Returned to work (n = 148)	Not returned to work (n = 38)	Odds ratio (CI)
Pain location last week			
Below knee, %	21,6	44,7	2,9 (1,4-6,2)
Location of most pain last week			
Leg, %	16,2	26,3	1,8 (0,8-4,3)
Duration of present pain			
More than 12 weeks, %	44,6	73,7	3,5 (1,6-7,7)
Probability of returning to work within 6 month			
Very sure (10 on a 10 point Likert scale), %	79,1	42,1	5,2 (2,4-11,1)
Interference of pain in daily activities			
Very important impediment (≥ 8 on a 10 point Likert scale), %	48,0	84,2	5,8 (2,3-14,7)
Currently, it's not advisable to be physically active			
Agree to strongly agree, %	54,1	84,1	4,5 (1,8-11,5)
Feeling of nervousness			
Much to very much	53,4	73,7	2,4 (1,1-5,4)
Feeling of anxiousness			
Much to very much	37,2	52,6	1,9 (0,9-3,9)
Oswestry disability index > 40%	33,1	63,2	3,5 (1,6-7,3)

Table 2 presents the results of this model. The regression coefficients indicate the magnitude of effect of each predictor on the log-odds of RTW with all the remaining variables held constant.

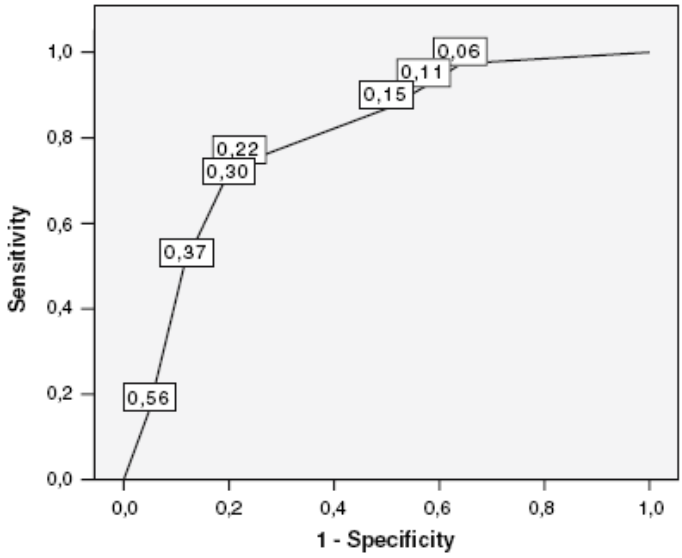
The model had a good ability to discriminate between the two outcome groups (c statistic = 0,801: 95% Confidence Interval: 0,727–0,876). LBP claimants who were not able to resume work within 3 months were more likely to experience pain below the knee, to have an own prediction of a 100% no RTW and to have a severe interference of pain on daily activities. In addition, age and sex were not significantly related to the RTW status.

TABLE 2. LOGISTIC REGRESSION FOR QUESTIONNAIRE ITEMS THAT BEST IDENTIFY CASES THAT NOT RETURNED TO WORK

Items selected by the regression	Odds ratio	95% CI
Pain below knee	2,5	1,1–5,8
Not very sure to return to work within 6 months (< 10 on a ten point Likert scale)	4,6	2,1–10,3
Very important interference of pain in daily activities (≥ 8 on a ten point Likert scale)	4,7	1,8–12,5

When plotted as a ROC curve, the logistic regression model was highly sensitive and specific in the sense that it was able to correctly identify 73,7% of the non-resumers and 78,4% of the resumers at the cut-off point of 0,22 (Fig. 1).

FIGURE 1. RECEIVER OPERATING CHARACTERISTIC (ROC) CURVE



4. Screening questionnaire

The three questions were rounded into weighted scores for a screening test (Table 3). Patient's own prediction of a 100% non-return or a severe interference of pain on daily planning are each indispensable and sufficient items to categorize a patient as having a high risk of non-resuming activities. LBP irradiating below the knee as such is an insufficient item to select high-risk patients. In the presence of one or both former items, however, it maximizes the discriminatory qualities of the model.

TABLE 3. SCREENING THREE-ITEM QUESTIONNAIRE FOR PATIENTS AT HIGH RISK OF NO RETURN TO WORK WITHIN 3 MONTHS. PATIENTS AT RISK HAVE A SCORE OF FOUR OR MORE

Question	Score
1. Where did you have pain last week?	
Back or above knee only Below knee also	0 2
2. In your estimation, what are the chances that you will be able to resume work in 6 months? Circle one number:	
0 1 2 3 4 5 6 7 8 9 10 No chance … Very large chance	10 = 0 9 or less = 4
3. How much has your pain interfered with your ability to plan activities? Circle one number:	
0 1 2 3 4 5 6 7 8 9 10 No interference … Very large interference	8 or more = 4 7 or less = 0

Discussion

Studies of the natural history of LBP show that it is a commonly persistent or recurrent problem and most workers do continue working or RTW while symptoms are still present.[12] Epidemiological studies show that early RTW with some persisting symptoms does not increase the risk of re-injury but actually reduces recurrences and sickness absence over the following years. We found that 20% of the claimants were unable to resume work at 3 months' follow-up. The natural history of back pain however is favourable since overall studies show that 30-60% of patients recovers in 1 week, 60–90% recovers in 6 weeks and 95% recovers in 12 weeks. Our no RTW figures may be inflated because the study population were claimants, whereas every patient with LBP will not necessarily introduce a claim. Additionally the results are not necessarily representative for all LBP patients. Our cohort consists of patients who claim a social insurance benefit and the results must be interpreted within the context of a compulsory social security scheme.

The present study has shown that the variables independently associated with no RTW within 3 months of sick leave principally involved patient's own prediction, sciatic pain and interference of pain in daily activities. The results found in this study are consistent with those of previous findings illustrating the diversity of the obstacles to RTW. Scientific evidence demonstrated that the development of chronic pain and disability depends more on individual and work-related psychosocial issues than on physical or clinical features.[1, 13, 14]

The patient's own prediction improves the prediction of RTW outcome. This corroborates with the evidence review for UK occupational health guidelines by Waddell and Burton. They found that the worker's own beliefs that their LBP was caused by their work and their own expectations about inability to RTW are particularly important.[4, 11, 17, 19, 27] A systematic review by Mondloch et al. summarized the mechanisms by which expectations can affect outcomes.[16] Self-efficacy, previous experience, vicarious learning,

verbal persuasion and social support were all thought to contribute to recovery expectations. Feelings and perceptions may affect biological processes through behavioural and non-behavioural mechanisms such as triggering of a physiologic response, helping to motivate patients to achieve better outcomes, conditioning the patient psychologically to observe certain types of symptoms and ignore others, changing the understanding of the disease, or provoking anxiety to heighten or reduce symptoms. According to Cole et al., expectations may provide useful information on the complex process of recovering from work-related soft-tissue injuries. For clinicians, patients' negative or uncertain expectations may indicate the need for further intervention on psychosocial factors to facilitate recovery.[3]

Severity of pain also appears to be an important predictor. Turk found that because pain severity is subjective it is influenced by numerous factors other than physical pathology.[24] Pain should be viewed as a psychosomatic factor that bridges physical and psychological domains.

Our study has demonstrated that sciatic pain is a significant predictor of no RTW. The likelihood of returning to work varied with location of pain, with sciatic pain patients being 150% more likely not to RTW. Similarly, neurological compression is a decisive predictor for the improvement in subjective disability in activities of daily living. This is not in line with the finding that bed rest is not more effective for treating sciatica than encouraging activity within comfort range.[26] Activity neither increases the risk of progression, nor does slow the rate of recovery. Acute non-progressive sciatica can be treated the same as mechanical LBP.

The risk-screening questionnaire was developed to identify the smallest possible number of questions that would permit acceptable discrimination between claimants who returned to work within 3 months and claimants who did not. Especially, patient's own prediction is a very important risk factor for disability and opens the perspective for modification by medical reassurance. The risk screening questionnaire developed from the three variables with the

greatest combined predictive power had very good discriminatory ability, with a cut-off score of four or higher indicating high likelihood of no RTW and low misclassification rate. The questionnaire is short enough and simple to score to be of practical application in a busy medical setting such as the medical adviser's practice in the sickness fund. The questionnaire could be sent to and completed by the patients. The medical advisers could score the questionnaire to help draw special attention to the 20% of claimants that would not RTW within 3 months. These claimants should be seen as soon as possible by the medical adviser of the sickness fund. There is strong empirical evidence that treatment at the subacute stage is more effective at preventing chronic pain and disability than attempts to treat chronic intractable pain and disability once it is established. One of the important treatment goals should be the carefully guided RTW of patients with a low back disorder. They need an intensive medical evaluation and a focused intervention. Our findings suggest possible mechanisms of sub-optimal efforts of rehabilitation and RTW.[18] Patient's fear can worsen, for example, if patients perceive an important influence of back pain on daily activities and if there is a dismissive approach by the physician. In this instance, patients may be motivated to seek treatment elsewhere entailing a risk on conflicting recommendations and further confusion. Evidence tells us that the essentials for a successful RTW are reassurance upon the benign condition of LBP, encouragement to return early to normal activity and early support in the workplace facilitating progressive return to normal work.[10, 25] Medical reassurance is probably the most cost-effective intervention for minimizing pain-related disability.[2] To do this successfully, health care providers must instill confidence in patients, which necessitates a careful physical examination and the willingness to take the necessary time to confidently reassure the patient. This may substantially alter patient's own prediction.

There are several drawbacks introduced by the study design and method. First, in the letter sent to the claimants it was emphasized that the information given by the patients was an important source of

knowledge for the medical adviser to accomplish his legal function as manager of sickness absence. Thus, it is possible that some patients would respond in a dishonest way to mislead the medical adviser. Second, the letter was not administered by trained interviewers but was sent to the patient instead. This aspect of the study enhanced the probability that the questionnaire was not filled out by the patient but by a relative or other person. This might have led to biased responses. A potential limitation of this investigation may also be the relatively small number of cases included. Given the small number of variables and the geographic range we feel able to conclude our study focussing on the most important predictors. Consistency and inter-rate reliability of the screening instrument have not been established. Our screening instrument is purported to assess the probability of RTW. Its predictive validity should be further investigated. In a planned intervention study a comparison must be made between the predictive value of the screening instrument and the actual RTW rate. Finally, our sample is drawn from a worker's compensation population; hence generalizing our findings to other settings must be done with caution.

The strength of this study lies in its prospective design and the inclusion of claimants from multiple regional offices and medical advisers of the sickness fund. By using multiple offices the study has limited the influence of medical adviser-specific factors during follow-up that might influence the RTW status.

Conclusion

Our results suggest that sciatic pain, patient's own prediction and severity of pain on daily activities are the factors robustly related to increased risks of non-RTW among claimants with LBP. A screening instrument based on these elements can identify social security claimants at risk of not returning to work within 3 months. The reliability and validity of the questionnaire has to be evaluated in a prospective intervention study.

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CHAPTER VI

GUIDING LOW BACK CLAIMANTS TO WORK.

A RANDOMIZED CONTROLLED TRIAL

M. Du Bois and P. Donceel (2012).

Spine, 37(17): p. 1425-1431.

"*Advice is seldom welcome, and those who need it the most, like it the least.*"

(Lord Chesterfield, 1694-1773)

Abstract

Study design. A single-blinded, randomized controlled trial.

Objective. To determine the impact of information and advice during a disability evaluation by medical advisers on the return to work (RTW) rate and recurrence of sick leave of claimants with low back pain (LBP).

Summary of background data. There is evidence on the importance of advice during the course of subacute LBP. The effect of informative interventions on RTW rates in workers receiving sickness benefit is not clear.

Methods. A total of 506 claimants with LBP were randomly assigned to the control group (disability evaluation) or the intervention group (combined counseling and disability evaluation). Return to work, sick leave recurrence, subsequent surgery and sick leave duration were measured during a 12 month follow-up.

Results. Patients who were provided information and advice showed a higher return to work rate which was statistically significant at one year. That result is mainly attributable to the lower relapse rate in the intervention group (38%) as compared with the control group (60%). There were no differences between the two groups regarding subsequent surgery for LBP and duration of sick leave.

Conclusion. Claimants should be routinely reassured and advised about LBP to allow early and safe RTW during a disability evaluation before any side effects of being sick-listed have settled.

Introduction

"Non-specific lower back pain" is defined as pain between the costal margins and the inferior gluteal folds.[27] This self-limiting condition is one of the most common reasons for claimants to consult in primary care. The disappointing return to work (RTW) rates and the many treatments of prolonged pain episodes put an increasing socio-economic burden on society.[13, 36] In Belgium, claimants with a lifetime inability to work because of musculoskeletal disorders including low back pain (LBP) have risen from 44,477 to 60,595 during a decade. They account for 25% of all claimants with a lifetime disability benefit among a working population of 5 million.[29]

The benign characteristic of LBP makes it an important preventable source of long-term disability, although many claimants experience symptom recurrence and functional limitations.[11, 15] It has been shown that prolonged absence from work due to non-specific LBP should be avoided because of its possible delay and detrimental effects on recovery.[17, 19] Pincus et al. demonstrated that psychosocial factors play an important role in the transition from acute to chronic LBP.[28] Strategies to resume work for claimants with LBP on sick leave aimed at reducing fear of avoidance of activity may reduce the number of days off work.[22] Especially for the subacute phase, high-level studies have provided good evidence of reductions in time lost from work by graded activity and an informative approach.[2, 5, 12, 16, 32] Despite the benefits of medical counseling, many people with LBP continue to be insufficiently able to resume work. However, there remains a dramatic paucity of literature addressing effective interventions for subacute LBP.[23]

Evidence is increasing on the importance of encouraging claimants with LBP to stay active in the management of musculoskeletal disorders and related disability.[10] Medical reassurance might be a key component to meet the challenges to improve the disability outcome of LBP. Investigating alternative models to evaluate and address disability shows promise.[31]

That especially applies to the medical adviser working in the Belgian compulsory social security system who is legally entitled to conduct disability assessments for claimants claiming a disability allowance. Although his profession explicitly comprises advising claimants, daily practice involves merely a formal disability assessment. As a consequence, the medical adviser adopts a passive stance denying his role as a potential facilitator for the claimant to resume activities.

To our knowledge, there is little evidence of a faster RTW and less chronic disability occurring as a result of an active follow-up by medical advisers.[8]

The aim of the present study is to compare the outcomes of an early rehabilitation-oriented approach with conventional care by medical advisers during sick-leave for claimants with LBP. In this randomized controlled study, we assessed the effect of information and advice to stay active on RTW and recurrence of sick leave due to LBP and disability. We postulated that an active role of the medical adviser as counselor would favourably modify the RTW rates.

Materials and Methods

1. Study design

The study is a single-blinded, randomised controlled trial comparing the efficacy of a rehabilitation-oriented coaching intervention (intervention group) with usual care (control group). It was conducted in accordance with the legal framework of disability evaluation in the Belgian social security system.

2. Subjects

Belgium has a compulsory health insurance managed by the National Institute for Health and Disability Insurance, which allocates a prospective budget to the sickness funds to finance the health care and disability costs of its enrollees. Every Belgian citizen is legally obliged to register with one of the six sickness funds. To apply for

sickness allowances, an employee must submit a certificate from a medical practitioner substantiating absence from work on grounds of illness. The employer provides 100% remuneration of normal wages during the first month of sick leave. After this period of guaranteed salary, an employee is entitled to 1-year sick leave on 60% of a limited annual wage rate paid by the sickness fund. If the certificate is complete and meets the basic legal qualifications (patient's name, diagnosis, starting date of sickness absence, and physician's signature), it is reviewed by the medical adviser who will take a decision about incapacity for work and determine whether a clinical examination is warranted and when. Sickness fund claimants can also simultaneously file a work-related injury claim in order to obtain higher workers' compensation benefits.

All persons except public servants introducing a claim for sickness allowances to a local Christian Sickness Fund during a 3-month period were eligible for participation in the study. Inclusion criteria included blue- or white-collar worker and a signed physician's sickness certificate diagnosis of LBP. LBP included pain in the lumbar region that may radiate to 1 or both thighs but not below the knee. Back pain encompassed common diagnoses such as lumbago, mechanical LBP, back sprain, and back strain without red flags, such as tumour, infection, inflammation, fracture, and neurological progression, including progressive sciatica, spinal stenosis, and *cauda equine* syndrome. LBP without sciatica in patients with degenerative disc disease was also included. Diagnoses at baseline were used. Claimants had to be employed to be included in the study. The following exclusion criteria were used: a sickness certificate diagnosis of a concomitant medical condition and LBP prior to scheduled surgery. Pregnant women and self-employed people were also excluded. Claimants who met these criteria between March 1, 2008, and September 1, 2008, were consecutively recruited and are listed in Figure 1. Claimants were kept unaware that 2 approaches for LBP were compared.

3. Sample size

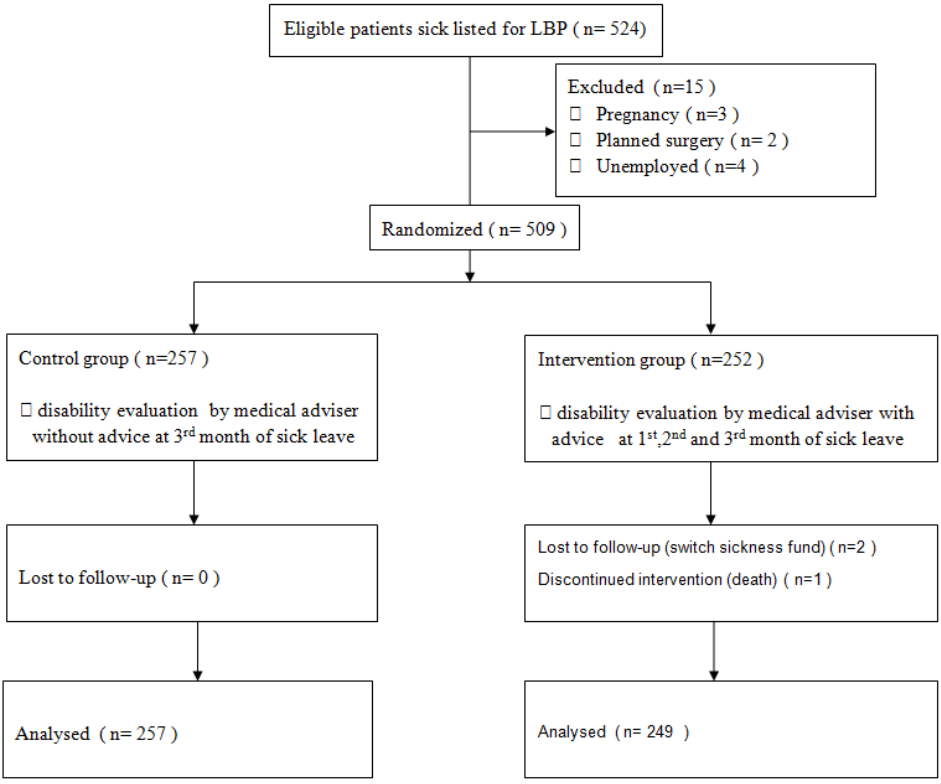
The sample size was estimated on the basis of the ability to detect a difference in RTW rates at 12-month sick leave. Assuming a reduction of 50% in RTW proportions between the intervention and control group with a type I error of 0,05 and a type II error of 0,80 a sample size of 250 in each group was required. We did not anticipate for a potential but minor loss of claimants by death or switch to another sickness fund during follow-up.

4. Randomization

The unit of randomization was the individual participant. Randomization was performed independently from the medical advisers involved in the recruiting and follow-up of claimants. The process took place in the central office of the Alliance of Christian Sickness Funds according to computer-generated random block lists to ensure a balanced sample size across both study groups. Potential claimants were divided into 17 blocks of size 30, consequently generating ordered ascending numbers from 1 to 30 per block. Each block was randomized allocating 15 claimants to code I (Intervention) and 15 patients to code C (Control). The numbers (1-30) of each block were written on the front of 30 opaque envelopes. The code corresponding to the number of the random block and to the front of the envelope was copied in the inside of the envelope. Envelopes were sealed and mailed to each participating local sickness fund immediately after randomization.

The sickness certificate that was included in the study was assigned an incoming number from 1 to 30 by a local administrator corresponding to the order of recruitment. The envelope carrying the matching number on the front was then opened and the participant was assigned to one group or on the basis of the code shown inside the envelope.

FIGURE 1. STUDY PATIENT FLOWCHART



5. Control group

The control group received a passive strategy composed of a brief disability evaluation without providing medical advice.

Three months after sickness, notification and acceptance, claimants were requested for a disability evaluation by letter. There was no previous oral or written feedback.

6. Intervention group

The intervention group included a proactive strategy keyed to facilitate a quick RTW in addition to the elements of the passive

strategy. Within two weeks of receipt of the sickness certificate, claimants were requested for a medical examination by letter. They are legally obliged to respond unless they have already resumed work.

The seven principles of the standardized advice are outlined in Table 1.

Claimants were invited for a follow-up physical examination at intervals of three to four weeks according to the systematic approach outlined earlier, provided they had not yet resumed work.

TABLE 1. MAIN MESSAGES GIVEN IN THE STANDARD COUNSELING

• There is no sign of any serious disease but a bad low back condition.
• A crack in a disc can cause inflammation and a reflex activation in muscles, leading to stiffness and pain.
• Being too careful and rest could worsen the stiffness and pain.
• Fear and anticipation of pain could increase muscular activation and pain.
• Light activity would not further injure the back, but rather enhance the repair process.
• 50% of de patients resume work safely in 6 weeks and the majority within 3 months of sick leave.
• Do not let the low back pain be your guide.

7. Outcome measures

Data on sick leave due to LBP were collected for both groups from an administrative database. RTW at three and twelve months was chosen as a main outcome measure because claimants remaining off work after two to three months account for the majority of the associated health care costs and have a substantial risk for permanent disability. In addition, a Belgian disability claimant will be considered totally

disabled if he is unable to do any kind of work for which he is suited and his total disability has lasted for at least one year. If the claimant is found to be totally disabled, he is entitled to an invalidity pension. The pension amounts to 65% of reference earnings and provides access to other benefits. Secondary outcomes include the mean number of days off work, including all episodes of sick leave, number of claimants with recurrent episodes of sick leave for LBP, and number of claimants with subsequent surgery.

8. Statistical analysis

Survival analysis using Kaplan-Meier curves and Cox regression was used to calculate RTW outcome, including time until recurrence and comparison between the two groups. Odds ratios as effect size and 95% confidence intervals were calculated for each of the categorical variables using univariate logistic regression. For continuous data, the Kruskal-Wallis test was applied. All data were analyzed by use of the Statistical Package for the Social Sciences, Version 16 software (SPSS Inc., Chicago, IL). All *P* values less than 0,05 were considered to be statistically significant.

Results

From March 2008 to September 2008, 524 claimants were enrolled in a randomized, interventional clinical study. A total of 509 claimants (290 men [57%], mean ± SD age: 41,7 ± 10,5 years) and 219 women (43%) (41,3 ± 9,9 years) were randomized to an intervention group (n = 252; 136 men [54%] and 116 women [46%]) and a control group (n = 257; 154 men (60%) and 103 women [40%]). Mean age of claimants at entry was 41,5 ± 10,3 years (range: 19–64 years). Mean age for the intervention group was 41,2 ± 10,4 years. Mean age for the control group was 41,8 ± 10,0 years. The intervention group consisted of 197 blue-collar workers (78%), and 39 claimants (15%) introduced a work-related injury claim. The control group encompassed 205 blue-collar workers (80%), and work-related injury

claims were found in 45 claimants (18%). Prior sick leave was reported by 153 claimants (61%) of the intervention group and 156 claimants (61%) of the control group. The two groups did not differ significantly regarding baseline characteristics (Table 2).

TABLE 2. BASELINE CHARACTERISTICS OF CLAIMANTS

	Control group (N = 257)	Intervention group (N = 252)	*P*
Age (mean, years)	42	41	0,48
Sex: male	154 (60%)	136 (54%)	0,18
Blue-collar worker	205 (80%)	197 (78%)	0,66
Work-related injury claim	45 (18%)	39 (15%)	0,54
Prior sick leave	156 (61%)	153 (61%)	1,00

1. Return to work

As shown in Figure 2, both control and intervention groups were comparable in terms of the cumulative percentage of claimants who resumed professional activity after the first episode of sick leave. However, significant differences were observed between the intervention and control groups with regard to time until recurrent sickness absence (Figure 3).

FIGURE 2. CUMULATIVE PROPORTION OF CLAIMANTS RETURNING TO WORK AFTER CLAIM INTRODUCTION EXCLUDING RECURRENT SICK LEAVE DUE TO LBP

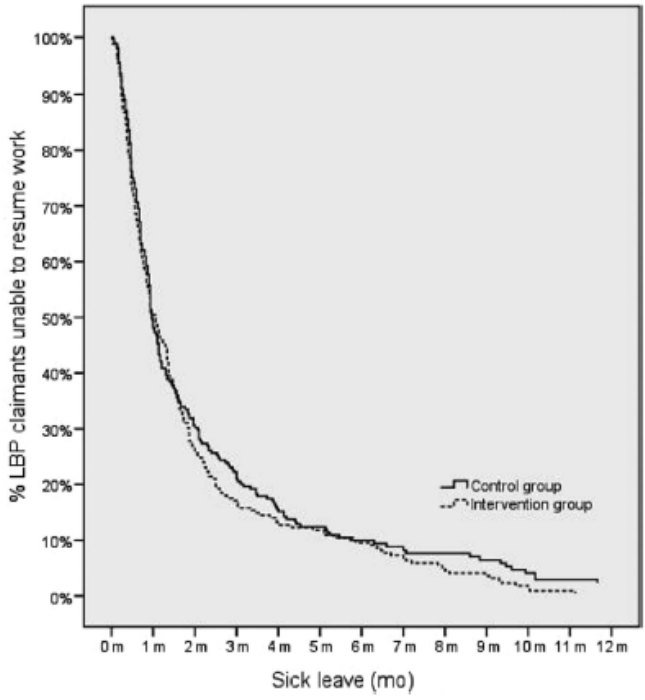
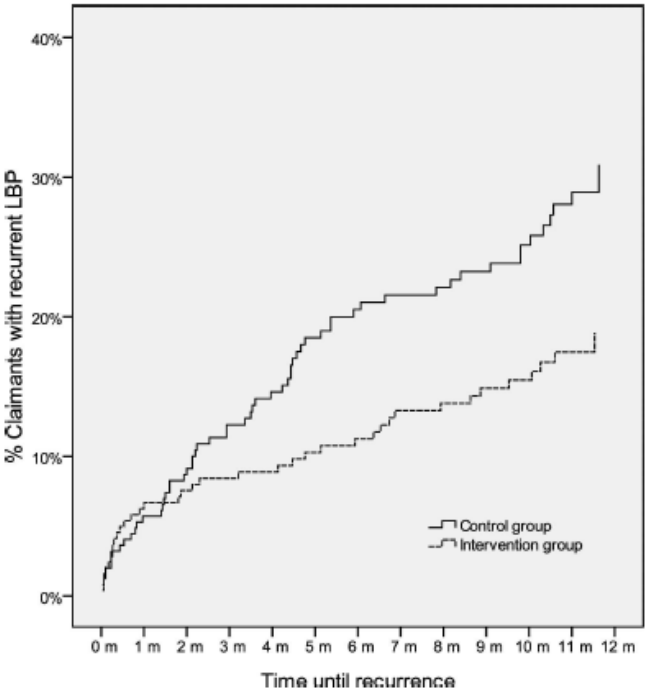


FIGURE 3. CUMULATIVE PROPORTION OF CLAIMANTS WITH RECURRENT SICK LEAVE DUE TO LBP



The percentage of claimants who did not resume professional activity at 3 months of sick leave was higher in the control group, but the difference was not statistically significant (Table 3). Conversely, one year after claim introduction, 21 claimants (8%) in the control group had not returned to work compared with 9 claimants (4%) in the intervention group ($P = 0{,}03$).

TABLE 3. MAIN AND SECONDARY OUTCOMES AFTER CLAIM INTRODUCTION FOR LBP DURING A 1-YEAR FOLLOW-UP

Outcome	Control group, n (%)	Intervention group, n (%)	OR (95% CI)	*P*
Off work after 3 months	60 (23,3)	44 (17,7)	1,42 (0,92–2,20)	0,11
Off work after 12 months	21 (8,2)	9 (3,6)	2,37 (1,07–5,29)	0,03
Recurrent sick leave	60 (23,3)	38 (15,3)	1,70 (1,08–2,66)	0,02
Subsequent surgery	12 (4,7)	10 (4,0)	1,17 (0,50–2,77)	0,72
Duration of sick leave (range)	75,9 (65,4–86,56)	63,9 (54,8–73,0)		0,16

2. Secondary outcomes

The average number of days on sick leave for the first episode was similar across the two study groups (Table 3). The average number of days on sick leave excluding claimants who underwent subsequent surgery was 71,2 days for the control group and 59,0 days for the intervention group. The proportion of claimants with one or more recurrences of sick leave for LBP was significantly higher in the control group. The proportion of claimants with subsequent surgery for LBP was similar across the two groups.

During the total follow-up period, the mean number of days on full benefits because of back pain was the highest in the control group with a mean of 75,9 days, whereas it was the lowest in the intervention group with a mean of 63,9 days. The total number of saved days on full benefit during the total follow-up period was 3,604 days for the intervention group at the expense of 249 extra consultations. A cost-effectiveness study from a societal perspective including service utilization in the health care sector and productivity costs is imperative to fully appreciate counseling as a low-cost intervention in the daily practice of medical advisers but falls beyond the scope of the present investigation.

Discussion

Our results show that combined counseling and disability evaluation by a medical adviser results in a higher RTW rate due to a lower sick leave recurrence than disability evaluation alone. The findings of our study are consistent with the results of Matsudaira et al. [24], who demonstrated that workers who were advised to stay active as much as the pain allowed had a lower risk for recurrence of low back strain than the workers who were advised to rest until recovery. They hypothesized that a physician's advice to stay active makes claimants more positive and optimistic and consequently decreases psychological stress, spinal loading, and injury risk.[24] This also applies to medical advisers. They should routinely provide claimants with LBP with advice, education, and reassurance of a favorable prognosis. It is an important adjunct to their daily practice of disability evaluation and may enhance the claimant's tolerance threshold to a safe RTW.

This brief intervention had no effect after 3 months but resulted in a high RTW rate after 12 months of sick leave. The statistically significant lower relapse rate and shorter time until recurrence of LBP account for the gain in RTW in the intervention group, which consequently materializes in the long run. The beneficial effect of an informative approach to LBP in terms of fewer recurrences of sick leave episodes has been addressed in a randomized controlled trial of Indahl et al.[14] They hypothesized that informing patients about the nature of their problem in a manner designed to reduce fear gives the patients the confidence needed to follow the advice.[14] They argued that the lasting behavioral modification is achieved only through positive experience. Waddell and Burton [37] also concluded in their review that there is preliminary evidence that interventions addressing beliefs and attitudes may reduce future work loss due to LBP. Our results demonstrate that these findings also apply in a disability compensation setting.

Our sample seemed representative of those who usually present with this type of LBP. We chose to include those claimants experiencing

nonspecific LBP because they represent the majority of claimants with LBP introducing a claim for sickness allowances. We chose not to include claimants with sciatic pain because they may represent red flags resulting in an unpredictable course of sickness and treatment.[26]

RTW was selected as primary outcome measure in view of the strong evidence base for early RTW as a part of the management of subacute LBP. The current legal role of the medical adviser encompasses disability evaluation of a claimant and enabling him to secure and retain suitable employment. Because education and counseling constitutes an essential part in vocational rehabilitation, the medical adviser becomes a partner in the vocational rehabilitation of claimants along with psychological, social and occupational strategies to re-establish the working capacity of sick or injured persons. The chosen outcome is in line with the findings of Liddle et al., who found an overemphasis on the use of measures of impairment within randomized controlled trials on the advice for the management of LBP at the expense of outcomes representing the restoration of activity and participation.[21]

Little research has been conducted on improving work resumption rates for the majority of claimants with LBP during a disability evaluation. According to Talmage, probably the best model to use in considering an individual's readiness for RTW involves the consideration of “risk”, “capacity” and “tolerance.”[34] Tolerance is related to the ability to tolerate the symptoms such as pain or fatigue produced by performing an activity the claimant clearly can perform when deciding whether the rewards of working are worth the “cost” of working to him or her. We hypothesized that counseling by a disability evaluator can probably improve tolerance and RTW.

We selected advice to avoid bed rest, if possible, to stay active and to continue with normal daily activities and reassurance that the condition is benign as the key points in the intervention for the experimental group. Current best practices state that this is the most simple and effective treatment option for people with non-specific

LBP after first ruling out serious conditions or red flags.[4, 7, 9, 18, 20] Moreover, since 2008, advice and counseling legally constitute an integral part of a medical adviser's job content beyond disability evaluation. For chronic LBP, however, there is strong evidence to support the use of advice to remain active in addition to specific advice relating to the most appropriate activities to promote active self-management.[21] The medical adviser may help to reinforce this key message already given by the general practitioner to claimants in the early stages of LBP, and dispel the fears and mistaken illness attributions that can often contribute to symptom chronicity.

Our results showed that 50% of the claimants in the control and intervention group resumed work within one month. A systematic review of the prognosis of acute LBP demonstrated that between 68% and 86% of claimants initially off work returned to work within one month.[33] This may be due to the differences between national social security systems, especially with regard to disability allowances eligibility, benefit amount and waiting times. However, the proportion of claimants who returned to work at three to six months in the intervention group was approximately 90%, which was in line with the reported figures in international literature.[11, 36] They demonstrate that subacute LBP can be managed successfully when adopting an active strategy.

As a general rule, LBP is likely to occur and become episodic leading to work disability. The risk of at least one recurrence within 12 months was 22% (16%–23%). This finding is in agreement with the research of Rossignol et al., who reported that workers with an initial episode of absence of one day had a 19,9% 1-year risk of recurrence.[30] Risk factors for recurrent episodes of work disability are: older age, poorer health conditions, protracted initial work absences and low decision latitude.[1, 35] Advice by the medical adviser was apparently instrumental in decreasing recurrences and is in line with the demonstrated effectiveness of worker education and active exercise programs.

Four percent of the included claimants underwent lumbar spinal surgery. Surgical treatment of the LBP remains controversial in term of efficacy. Surgical treatment is advocated only when conservative management fails, a clearly identifiable cause of lumbar pain is identified, worker's compensations are detected, psychological disorders are treated, and disability and pain are still present.[3, 6] Webster et al. found subsequent surgery in 10% of a retrospective cohort of worker's compensation claims with acute disabling LBP. They demonstrated a negative association between early opioid prescribing and surgery.[38] Given their adverse effects on recovery, we hypothesize that advice on the appropriate use of opioids should also be an important part of counseling by medical advisers.

The major weakness of this study is that because of the nature of the intervention, it was not possible to blind both the claimants and the medical advisers to the group allocation. Consequently, we were not able to quantify the potential Hawthorne effect in the intervention group.[25] This could undermine the validity of the results in daily practice because subjects might improve or modify their sickness behavior in response to the received attention by the medical adviser and not necessarily by following the given advice. Another drawback is that the generalizability of the results may be limited to compulsory health care systems based on solidarity and without risk selection and to the extent of disability coverage. An important strength is that the study was designed as a randomized comparison with 100% follow-up. Claimants were assigned to experimental and control groups using a concealed random allocation procedure.

In conclusion, this study found that a rehabilitation-oriented approach resulted in less recurrent sickness absences over natural recovery alone for LBP claimants. No differences between the intervention and control groups were found for both the subsequent surgery for LBP and duration of sick leave. According to these results, we recommend that claimants should be routinely reassured and advised about LBP to allow early and safe RTW during a disability evaluation. Our results indicate that successful interventions require very early

initiation within 6 weeks of sick leave before any side effects of being sick-listed have settled.

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GENERAL DISCUSSION

"*It is better to debate a question without settling it than to settle a question without debating it.*"

(Joseph Joubert, 1754-1824)

The dissertation provides a scientific inquiry into the causes and prevention of long-term disability due to low back pain (LBP) from the viewpoint of insurance medicine. Part 1 deals with disability following lumbar spine surgery and concentrates on the epidemiology, outcome and cost of surgery for disc hernia, disc replacement and spine surgery in general through a series of three retrospective studies. Part 2 tackles the issue of the prevention of disability due to non-specific LBP. The initial phase of the prospective research started with the identification of risk factors for prolonged disability in a cohort of LBP claimants followed by the development of a screening tool. The study was concluded by exploring the preventive value of counseling as an adjunct to disability evaluation.

Disability following lumbar spine surgery

1. Main findings

Over the past two decades lumbar spine surgery in Belgium has demonstrated remarkable growth and data showed twofold variations in spine surgery rates among Belgian provinces. When comparing surgical interventions, we found spinal fusion associated with poor return to work status. In multivariate modeling, duration of sick leave before surgery was the most significant factor associated with not returning to work. Overall, the longer the period of sick leave before surgery, the less likely the claimant will resume work. The non-inferiority of lumbar disc replacement in terms of return to work as compared with a traditional fusion procedure was established.

2. Methodological issues

We looked at a specific group of surgical procedures using data from the largest Belgian sickness fund covering approximately 42% of the country's mandatory insured population. The nation-wide sample size provided a sound base for the general findings of the study, although our results may not generalize to settings with no compulsory health

care system. This approach enabled us to study population-based cohorts over an extended period of time at minimal cost since information was available in computer-usable format and no hard-copy review or data collection was needed. To our knowledge, our study used the largest patient cohort to date to analyze the surgery rate and outcome of lumbar spinal surgery

The retrospective studies were multi-centered and representative of the larger population of patients who underwent surgery for lumbar spine disorders. The large number of surgical interventions per geographic region implied that our study was sufficiently powered to detect regional differences.

In general, sickness fund data integrity is affected by procedures such as hand-keying and receiving data from different sources. However, there is no underestimation of the true rates of lumbar spine surgery caused by major gaps in reporting or inaccurate coding since these data files are subject to audit by federal law.

The primary data that sickness funds receive from providers are claims for payment which are less informative than actual chart reviews. Nonetheless, a claims-based database also can document geographic variation in health care delivery and utilization as a useful approach for peer comparison.[12, 14]

Other data-related problems might arise as a result of insufficient sample sizes which may impact on drawing valid inferences. It hardly affected our research though, since it was based on data from the Alliance of Christian Sickness Funds, which is a 4.200.000 member social health care insurer covering approximately 42% of the mandatory insured population.

Outcomes were objectively measured in terms of return to work, iterative surgery and mortality. Different results might have been found with other performance measures, such as patient-reported outcomes. Despite the lack of patient-reported outcomes, return to work is a relevant clinical outcome measure.

A few constraints on the applicability of these studies should be noted. We acknowledge that the retrospective studies rely on the availability of recorded data from a social insurer. Information such as co-morbidities, type of surgery, spinal level, and clinical findings are not recorded in the administrative database. The database consists of nomenclature codes which are numbers assigned to every task and service a medical practitioner may provide to a patient including medical, surgical and diagnostic services. The procedure codes are eligible for reimbursement and not intended for research purposes. As a consequence, they did not allow for differentiation between diagnostic categories. The current numerically encoded system does not ensure uniformity since every surgeon does not necessarily use the same codes for the same medical service. Additionally they do not match with the Current Procedural Terminology (CPT) code set developed, maintained and copyrighted by the American Medical Association (AMA) and as such impede comparisons between local and internationally reported surgery rates.

Belgium's two largest regions are the Dutch-speaking region of Flanders in the north, with 59% of the population, and the French-speaking southern region of Wallonia, inhabited by 31%. The Alliance of Christian Sickness Funds holds almost a 42% share of the market when the Flemish and Walloon regions are combined. However, in Wallonia the Christian Sickness Fund is relatively underrepresented with 28% market share versus 55% market share in Flanders. Hence, results related to the French-speaking southern part of Belgium may be biased.

A major drawback is that the current retrospective research on lumbar disc replacement did not expose this procedure to the acid test of a sham- controlled trial. Instead we compared lumbar disc replacement to lumbar fusion. Although fusion is considered a standard surgical treatment for back pain due to degenerative disc disease, doubts remain about its beneficial effect, as clinical trials comparing fusion to nonsurgical alternatives show conflicting results.[43, 59] Our finding that lumbar disc replacement is not inferior to the unproven lumbar fusion provides no evidence about its effectiveness.[5] Disc

replacement has to be proven to be superior to spinal fusion in randomized controlled trials instead.[29]

Admittedly, an important part of our research on low back surgery was based on old data including historical cohorts from 1999 through 2004. Even if some of our findings date back to more than 10 years, our recent research covering a decade of experience on spine surgery, showed that the results are still valid today and correspond fairly well with international studies.[23]

3. Implications for practice and policy

Despite the methodological limitations, our findings have several policy implications. The retrospective studies demonstrate a need to scrutinize the role and timing of surgery for lumbar spinal disorders.

1) Surgery rates

The annual volume of spinal surgeries has increased substantially over the past decade and will continue to increase as new techniques and devices are more generally available and gain acceptability. The growth in the rate of lumbar fusion surgery is out of sync with the scientific evidence. There is still controversy surrounding the clinical benefit of spinal fusion for degenerative disc disease and for non-specific low back pain its overall benefits are uncertain.[54] The available research points to a modest benefit from surgery that is no better than intensive multidisciplinary rehabilitation.[10] Appropriate treatment for patients considering becoming candidates for spinal fusion would be a structured rehabilitation program with a cognitive behavioral orientation. Spinal fusion should be limited to a very small patient population with explicit evidence of instability.[8]

Furthermore, our figures are striking in light of the lack of an obvious increase in spinal disorders. In general, spinal surgery should be applied to a selected group of patients.[13] It is generally assumed that the firmer the indications, the more predictable the surgical results.

2) Disc replacement

Our study questioned the use of disc replacement when standard methods would suffice and where patients have larger co-payments for more expensive treatments that are no more effective than less expensive ones.

Private insurance coverage is probably important in the wide-spread use of disc replacement in Belgium. These trends reflect complicated issues: a research and regulatory system that does not adequately evaluate the safety and efficacy of new technologies, lack of sophisticated post-marketing surveillance for new devices, a general absence of early comparative effectiveness research and a reimbursement system that does not adequately reward evidence-based surgical practice.[62] Taking an alternative approach, insurers can deny any reimbursement until developers of artificial discs produce unequivocal compelling evidence on the safety and superiority of their devices.

The current data support the recommendation of the Belgian Health Care Knowledge Centre that available scientific evidence does not convincingly demonstrate the safety and efficacy of disc replacement.[31] Since the procedure involves substantial risks, the widespread use of total disc replacement for single-level degenerative disc is not justified. A cautious approach is warranted and disc replacement has to be restricted to clinical trials and ideally be limited to carefully selected patients until better evidence emerges.

3) Length of preoperative sick leave

The length of sick leave before surgery was the essential factor that was associated with ability to work after operation. The optimal timing of spinal surgery however has not been scientifically established.[53] International consensus states that surgery should be applied only if symptoms persist after a period of conservative treatment. Delayed treatment prolongs disability, which is associated with development of chronic pain conditions and poor return to work rates.[36] Our findings point to a careful selection of suitable patients

and prompt surgical treatment when an operation is indicated. A short period of sick leave prior to surgery will improve the patients' chances of being able to return to work postoperatively.[24] For claimants with a high number of total days off work before surgery, conversely, physicians should be cautious when considering the role of surgery.

4) Regional variation in spine surgery and outcome

Our results for 2009 showed that the French-speaking southern region of Belgium (Wallonia) exhibited lower overall RTW rates (74%) in the first year post-surgery than the Dutch-speaking region (Flanders) (80%). Although we did not specifically investigate the reasons for this difference, we speculate that this finding may be attributed to historically determined socio-cultural differences between the two regions. Thus, Wallonia is often considered to have been more influenced by a "Latin collectivistic culture", whereas Flanders has been more influenced by a "Germanic individualistic culture".[11, 40, 45] This situation may be comparable with that observed in a Dutch study on regional differences in sick leave, where the highest disability pensions and unemployment rates were found in the more "collectivistic" Limburg area.[3] Szpalski et al. showed that language as expression of culture translates into reported prevalence of LBP but not into health care behaviors in the Belgian universal coverage health care system.[51] However, they demonstrated that Walloon health care providers were more likely to prescribe imaging. A radiologic investigation may contribute to patients' belief that LBP would be a serious lifelong problem requiring spinal surgery. Regional differences in economic developments may also be involved.[40] Wallonia experienced a mainly structural unemployment for many decades, in contrast to Flanders, where unemployment is rather cyclical. At the time of the study, Wallonia's unemployment rate amounted to 10,1%, whereas Flanders recorded a substantially lower unemployment rate of 3,9%.[20] The high unemployment rate in Wallonia may be compatible with a rise in co-morbidity and consequently a high permanent sick leave, as evidenced by Waddell and Burton.[55]

On the other hand, low back surgery rates were higher in Flanders than in Wallonia. This finding is in apparent disagreement with a previous population-based survey where claimants with LBP of low socio-economic status were more receptive to surgery and, hence, experienced higher surgery rates than patients of high socio-economic status.[51] However our data support the officially reported regional variation in health care spending and policy, Walloon expenditures on health care mainly relate to specialist care, medication, imaging and lab services, whereas health care expenditures in Flanders mainly comprise general practitioners' care, nursing, surgery and implants.[45]

Significant differences in spine surgery practice patterns over time and between regions, highlight the inadequacy of surgical care in Belgium and a broad lack of adherence to evidence-based standards.[15, 28] Our results call for leadership and reform in the back pain field. Leaders in spinal health care must move more forcefully in developing, disseminating and encouraging surgeons to accept and implement evidence-based clinical practice guidelines. Even when codified into clinical practice guidelines, current evidence-based findings, are not widely adopted in present surgical practice. The social security system is struggling how best to overcome barriers to implementation, and to motivate providers to use evidence-based guidelines. As stakeholders sickness funds are highly concerned with quality of health care and the role of financial incentives in shaping clinical practice patterns.

As decision makers, sickness funds have an important role in the public release of data on the performance of healthcare systems to facilitate the decisions and behaviors of various stakeholders like healthcare consumers and providers in order to improve the health care system.[32] The main role of performance measurement is enabling stakeholders to make informed decisions. Since the majority of surgeons in Belgium still work in solo or small-group practices and make individual-level decisions, assessing individual physicians' performance continues to be the appropriate way to profiling. In general physician profiling involves the collection and analysis of

data on practitioners' patients from databases.[42] An in-depth review of current spine care on physician level is important for benchmarking against international practice and to verify if standards and guidelines are being met. Our retrospective study on spine surgery in Belgium is a comparative performance assessment or profiling on provincial level and may provide impetus to performance measurement on provider level.

The public disclosure of performance measurements as exemplified by our research of a statistical sample of sickness fund data should encourage providers to focus on quality problems and to stimulate performance improvement. Considerations of usefulness, practicality, legality and ethics do come into play when profiling providers against a peer group.

The geographic variety in surgical performance is a factual account of what actually happens in the field of spinal care. These data provide arguments to prominent opinion leaders to correct those who engage in excessive surgery and ethically dubious practices. In serving these objectives publicly releasing performance data must adhere to sound research and statistical principles with regard to the validity of the performance measures themselves and the validity of comparisons. Concerns may arise over inadequate risk-adjustment for differences in case mix in the data sets so that surgeons who treat higher-risk patients are erroneously labeled as poor performers. These basic rules also apply in case of providers preferentially selecting lower-risk patients. Provider profiling against a peer group adjusted for age, sex, case mix and severity of illness yields the most accurate, meaningful comparisons. Obviously, reliability of key measures should also be adequate to prevent misclassification of providers because of random chance. For profiles to be reliable a sufficient number of patients per provider must be sampled and variation between providers must be sufficiently large relative to variation within providers.[18] These are concerns that are appropriately addressed by the large sample sizes of sickness funds. It is arguable that reliable performance measurement is feasible using data from an single health care insurer with substantial market share as employed in our retrospective research.

On the consumer's side, patients should be encouraged to get involved in patient-physician discussion before engaging in spine surgery. Sickness funds have expressed their clear intention to promote best practices specifically for low back pain, which constituted the most common disease among their claimants. Better scientific evidence through public reporting would allow patients to influence surgical practice through informed choice and shared decision making with the treating physician and medical advisers of sickness funds. Medical advisers should play a role in restraining inappropriate surgical practices while respecting medical ethics first and foremost in their relationship with other healthcare providers. Information about the relative risks of alternative procedures should be part of their disability evaluation process. It is proven that if patients are given good information they generally choose the least invasive and less risky procedure.[64]

Social Security should update and review existing reimbursement criteria for spine surgery in order to align with evidence-based clinical guidelines.[10] Financial incentives must comply with current clinical best practices to encourage providers to practice high quality and cost-effective medicine rather than high-volume medicine without regard for quality of care which inherently applies to fee-for-service systems.

The reimbursement criteria for fusion surgery have to be revised and brought into accordance with the criteria established by the American Pain Society Clinical Practice Guideline. Pay for performance as concept to align reimbursement to quality is a useful adjunct to the current model and is gaining acceptance by sickness funds. Participation and quality reporting remain the main constituents of a pay for performance scheme.

Biomechanical testing of new devices should be followed by pilot studies and randomized-controlled trials comparing the new technique to the existing golden standard for the treatment modality in question.[63] The final proof of the value of the new technique is documenting its effect when implemented in general practice of spine

surgeons. Professional bodies of spine surgeons should foster clinical cost- effectiveness research and strengthen clinical monitoring in general. This is vital so that health care stakeholders can at least measure and report the outcomes and tradeoffs involved by alternative treatment and patient-management approaches.[61] Here, broad registrations like local and national registers are important to achieve quality assurance and observing trends. A common platform of baseline data can be provided by professional bodies such as Spine Tango, administered by the Spine Society of Europe, which would strongly facilitate international comparisons.[1] Quality and outcome of the register can be enhanced by the input of sickness fund data. Conversely, it is obvious that our retrospective study on spine surgery in Belgium would gain momentum if it additionally incorporated information about preclinical status, intra-operative findings and complications.

In our retrospective research, measures of care were compared between geographic populations of providers and broadly against national standards regarding quality of care. Moreover, sickness fund data are eminently suitable for purposes of resource utilization and cost. By focusing on in-depth provider data sickness funds can influence physician practices to be more efficient while still maintaining acceptable levels of quality of care.

4. Future research

Unfortunately, our retrospective study comparing disc replacement with spinal fusion among sickness fund beneficiaries includes combined patients with different diagnoses. In that respect it is not possible to determine if disc replacement is effective or ineffective for any single indication in this population compared with spinal fusion.

There is a need to conduct randomized controlled trials comparing the disc replacement to other spinal fusion techniques or to conservative care.

Future research is needed to investigate the exact impact of geographical variation in practice patterns in terms of the various

outcomes. In addition to the variation seen in practice patterns, a wide variation was observed in patient outcome. Variation in mortality, repeat surgery and return to work outcomes may be a result of differences in practice patterns, patient populations or the experience or training of spinal surgeons. Further research is also needed to determine modifiable factors associated with quality indicators in order to help surgeons achieve high-quality spinal surgery.

Further prospective research should also be conducted to examine the indications for surgery, including the time between start of sick leave and surgery in order to more accurately determine whether the current guidelines are being met. In addition, there is an urgent need to compare various treatment outcomes among patients who have relatively homogenous underlying conditions. This is a call for revising the current reimbursement system in spinal surgery and to include ICD diagnosis.

Prevention of disability following non-specific LBP

1. Main findings

Elevated Oswestry disability, fear of avoidance, blue collar work, abnormal pain behavior and a long back pain episode before disability were strong predictors of continued disability claims after 3 months. A screening tool comprising pain localization, patient's own prediction and interference of pain in daily activities correctly identified 74% of the non-resumers. Counseling of claimants during disability evaluation resulted in a higher RTW rate due to a lower recurrence.

2. Methodological issues

The present studies were based on a well-defined cohort of LBP patients enrolled consecutively with complete follow-up of working status including disability compensation coverage which is mandatory for all citizens in Belgium. Diagnoses were obtained from sick leave certificates filled out by treating physicians. Risk factors were

investigated using 12 validated standardized instruments to maximally cover the bio-psycho-social framework.

RTW data were complete with no data loss. Other strengths of the studies include a prospective design and a representative sampling from the largest Belgian sickness fund covering approximately 42% of the mandatory insured population. Conclusions of the prospective research on risk factors and screening, however, are possibly flawed by reliance on patient self-reported data.

Limitations of the studies include their primary focus on return to work as outcome and the relatively short follow-up of one year. However, RTW is a key component of rehabilitation according to the International Classification of Functioning, Disability and Health (ICF).[7] The merit of return to work as outcome measure lies in its availability in administrative databases uninfluenced by reporting bias. On the downside, RTW is only applicable to workers and it does not encompass process measures such as presenteeism or modified work. Furthermore, RTW is affected by economic growth and labor market policies unrelated to an individual's level of disability. RTW is also often measured as a dichotomous outcome which reduces statistical power. However, RTW may also be conceived as a time-to-event measure or as time to recurrence as we applied in our randomized controlled trial.[9]

Generalization of the results is partially limited. Our findings are based on a representative sample of the Belgian population though results more accurately generalize to the Northern Belgian population because of the relatively higher number of Dutch speaking enrollees sampled (66%) and the market leadership of the Alliance of Christian Sickness funds in Flanders (55%). The prospective cohorts included blue or white collar workers with a certified diagnosis of lumbago, disc hernia or dorsal pains without red flags. All studies included claimants with nerve root irritation since proper management of sciatic pain is identical to NSLBP treatment unless progressive neurological deficits develop. Findings are not likely to be representative of self-employed people, pregnant women and

claimants suffering from LBP due to tumor, trauma, infection, fracture or LBP with neurological progression. Also excluded from the study were claimants with a concomitant medical condition and LBP prior to scheduled surgery. Finally, only outcomes of claimants sick listed for 4 to 6 weeks were examined. While this group comprised over half of the study cohort who initially submitted a sickness certificate, they are at higher risk of not returning to work given the inverse relationship between length of sick leave and probability of resuming activity. Furthermore, Belgian social security legislation and disability practice pose a real challenge to generalization given the observed dissimilarities in international sickness and disability insurance systems.[58]

Another methodological issue concerns the development of the screening tool. Our brief screening tool was designed in a second study after we had identified risk factors. Only two out of the initial five factors from the first study were retained. Several methodological factors may explain the discrepancy between the findings of the two investigations. First, the five initial predictors were identified using a battery of twelve self-administered questionnaires. By contrast, the short screening tool was developed using a single questionnaire with eight items including the initial predictors and the Oswestry Disability Scale. By applying a limited set of questions, we avoided item redundancy and thus reduced participant fatigue and superficial answering of too many highly similar questions. Secondly, the series of twelve questionnaires were filled out during the first medical adviser visit that took place at 4 to 6 weeks of sick leave, whereas the only questionnaire in the creation of the screening tool was completed within 2 weeks after claim submission. Consequently, we had no control over the identity of the subjects who completed the postal questionnaire, which was a potential source of bias in the second study. Finally, the target population of both studies differed in duration of sick leave, which certainly influenced RTW rates, predictors and the ultimate study results.

Items for the screening tool were generated through a comprehensive literature review and risk profiling on existing disability measurement

scales in a prospective setting. We measured criterion validity against RTW as a golden standard. Some important psychometric properties such as content and construct validity combined with intrarater and interrater reliability in case the scale is administered by physicians, need to be evaluated. Our results show that the screening questions have good predictive ability in disability settings. Our experience with the short screening tool suggests clinical acceptability by medical advisers. Future research with new samples will be needed to replicate these results and determine validity and reliability.

Of particular note is how the intervention was standardized in the randomized controlled trial. The intervention essentially embraced several different aspects of counseling such as education about LBP, medical reassurance and encouragement to maintain activity and resume work. An effective medical adviser, however, must be skillful to convey information and messages appropriately. The comprehensive instructions that were issued covered essentially the content of the communication between medical adviser and claimant. Motivation improvement and strategies that facilitate the delivery of health messages to help get claimants the counseling they need to resume work as soon as possible, however, were not dealt with. A similar concern applies to the usual care that was provided to the control group. Usual care is an umbrella term that covers in principle disability evaluation but does not rule out disability management by education and assurance making it equivalent to counseling in the intervention group.

3. Implications for practice

In usual practice of disability assessment of non-specific low back pain (NSLBP), medical advisers base their decision on a number of formal criteria supposed to be risk factors for long-term sickness absence including sick-spell history and unemployment. Sick leave track record and employment status are readily available in sickness funds. Claimants unlikely to resume work are invited by letter to participate in a medical appointment.

1) Risk factors

Selection of high-risk patients in current practice is founded largely on intuition and experience rather than merely on scientific evidence. A better availability of sick leave prognosticators should improve the possibilities of the medical adviser to arrive at a reasonable sick leave prognosis. Early detection of patients at risk for long-term sickness absence also is important to identify individuals in need of rehabilitation measures in order to resume work.[25]

Our findings suggest to include psychosocial factors in the routine history taking for a new onset of LBP disability. Apart from the Oswestry disability index, blue collar work and symptom duration, the predictors only included two psychosocial and no clinical measures. In the first weeks of sickness absence work resumption was confidently predicted by a set of five questions including patient's own prediction, pain interference, fear of avoidance and affect. Hence, if medical advisers are to make a contribution to reduction in prolonged disability, they should be more receptive to cognitive-behavioral approaches and less confident about the biomedical principles of disability assessment and management.[48]

Among the predisposing factors, patient's own prediction and fear of avoidance are the most amenable to change by medical advisers during a disability assessment.[21] It is generally assumed that sick-listed individuals predicted the length of sick leave more accurately than professionals.[37] We presume that asking patients for their opinion early in the course of sick leave will provide clues to impact on patient's return to work. The ability of medical advisers to identify, interpret and alter patients' self-estimated ability to return to work may hold the key to successful disability management.[46]

2) Screening

The second study aimed to reappraise the utility of risk factors involved in the development of long-term disability of low back pain claimants as identifiers of "at-risk" cases for targeted intervention.

The outcome of this research allows translation of risk factors into a screening instrument.

In practice, no method of screening ever approaches 100% correct prediction and accuracy. In the development of a screening instrument there has to be a "trade-off" between false-positive errors identifying claimants as being at risk when they are not really and false-negative claimants who are at risk but would not be identified by the screening tool. The ability of any test to discriminate between those who go on to long-term incapacity and those who do not is commonly measured by its sensitivity and specificity. In general, clinical screening tools tend to opt for high sensitivity to minimize false negatives and select in as many people as possible who might benefit from an intervention. Conversely, screening with high specificity improves the efficiency of selection, minimize false positives and reduce claimants who might be provided with an intervention that they do not need and ultimately result in deadweight losses. The economic definition of deadweight refers to claimants who receive an intervention but would have resumed activity without intervention and as such undermine cost-effectiveness.[56]

The clinical definition of deadweight encompasses those who would have returned to work anyway, the so-called economic deadweight, plus those who do not respond to the intervention and remain on lengthy sick leave. Using the economic definition screening would need to screen out claimants to resume work anyway without intervention. Using the clinical definition screening would need to screen in claimants likely to respond to an intervention. Economic deadweight is the converse of the probability that the patient is truly positive if the test is positive, the so called positive predictive value of the screening tool and is mathematically related to the false positive rate and the specificity. Our screening questionnaire has a false-positive rate of 32/186 = 17%, the specificity is 116/148 = 78%, de positive predictive value is 28/60 = 47% and the economic deadweight is 32/60 = 53%.

The positive predictive value depends on the prevalence of the disease in the population as well as on the sensitivity and specificity of the procedure used. The prevalence of disease corresponds to the prevalence of the non-resumers in our research. The lower the prevalence of true positives that is the claimants that will never return to work, the lower will be the proportion of true positives among test positives and the lower, therefore, will be the positive predictive value.[33] The economic deadweight can reasonably be applied at the acute stage of sickness absence where the large majority of claimants spontaneously return to work quickly. An unnecessary intervention at that stage may do more harm than good by delaying natural recovery. Applied at a more chronic stage where 80% claimants make the transition to long-term disability, the positive predictive value rises dramatically while sensitivity and specificity remain constant. Here the focus shifts away from economic deadweight onto a concern about cost-effective interventions to minimize clinical deadweight. Nonetheless many studies have demonstrated that early return to work interventions are the most effective method of reducing incapacity in the longer term.[26, 27] Accordingly, it can be argued it is preferable to maximally select in so as to minimize the chances of missing a positive case, even at the risk of including more cases that turn out to be false-positive.

Screening can be implemented by use of patient-reported measures but some are time-consuming to promote their use in disability assessment settings. If kept simple, brief and easy to handle they may be a useful tool to identify claimants at risk. For convenience we developed a single composite assessment tool with a small number of items to assist medical advisers in sorting out those claimants at risk from long-term disability. Our simple screening questionnaire contains 3 items and takes about 5 minutes to complete. The items add up to a total score that is an estimate of risk and the instrument also provides a basis for illuminating difficult problem areas in a subsequent interview. Especially, patient's own prediction might be amenable to change by suitably trained medical advisers.

3) Disability management

Our prospective studies provide guiding principles for the initial assessment and early management phase of low back pain disability with a primary focus on rehabilitation and return to work.

Medical advisers play a pivotal role in assessing the potential impact of injuries and diseases on a patient's ability to work. They are also legally involved in disability management. They assist in decision making about the employee's readiness to RTW, but often feel ill-equipped to offer advice in this area. Legal interventions by medical advisers that facilitate a successful rehabilitation include modified work.[16]

Traditional disability evaluation is characterized by a unilateral focus on disability assessment with little emphasis on return to work strategies. This current approach ignores the fact that occupational disability is a consequence of both social barriers and claimant's personal traits. However, various studies established the added value of a bio-psycho-social approach compared to an isolated biomedical approach in primary care settings.[2, 57] Guidelines suggest that patients at risk for delayed recovery should be identified early and receive a multifaceted therapy considering biological, psychological and social factors.[4] Additionally our results support a rehabilitation oriented approach in disability evaluation based on both biomedical and cognitive-behavioral principles. This approach builds on the flags framework to determine risk of poor outcome and to identify the ways to modify behavior.[39] Our intervention underscores the need for a paradigm shift in disability evaluation. The primary goal of this strategy is to prevent the development of long-term disability because of pain. This approach shifts the focus onto modifiable issues such as the control of pain, the exploration of attitudes towards pain and the identification of anxiety.[25]

Beliefs, emotional and behavioral responses have been long recognized as important concomitants of low back pain and disability.[21, 48] The literature to date has focused primarily on the role of fear avoidance and pain catastrophizing.[44] In a rehabilitation

oriented disability assessment, these beliefs are a primary focus of medical advisers in the management of disability.

Following low back pain, the vast majority of claimants return to work within 3 months. The evidence now points to return the employee to work as quickly and safely as possible to prevent disuse atrophy.[60]

Whilst an in-depth assessment of low back pain disability may offer a coherent account of the claimant's fitness for work, opportunities to speed recovery and subsequent RTW may be missed. Our findings demonstrated that a significant proportion of low back pain claimants are able to engage in sustainable gainful employment providing they are offered comforting information and guidance on low back pain. Medical advisers can use the risk factors we found to identify low back pain claimants at risk of a prolonged disability and provide evidence-based interventions to assist in making a successful RTW. Important modifiable risk factors are patient's own prediction and interference of pain in daily activity. Medical advisers should simply address unmet needs for coping with pain by medical reassurance and support. Claimants at risk should be counseled to change mistaken beliefs and inappropriate behavior to enable a quicker and safer return to work without re-injury. The primary goal is to establish sustained behavior change in claimants as evidenced by the significant lower relapses in our randomized controlled trial.

Furthermore, our intervention points to the need of a regular follow up. Re-assessment at regular intervals remains important to gauge progress and to tailor management. Any setbacks need to be addressed by an in-depth analysis of "red flags" as indicators of serious pathology and yellow or blue flags as markers of psychological or work-related issues respectively.[6, 34] Muscle imbalance is always a matter of concern and should be addressed accordingly.[41] A physical conditioning program with supportive counseling, enables claimants to conquer their fear of resuming a physically demanding activity.

It is also important to underscore that a useful guidance for claimants in need certainly is beneficial both for the individual's health and social security. Our preliminary data seem to demonstrate the long-term payback of this counseling. The effectiveness of counseling for LBP might be improved if combined with claimant screening to identify those unlikely to resume work.

In our prospective research we did not take the opportunity to tailor disability management to risk profile. Yet, the linking of high-risk claimants to targeted counseling offers promise as a very cost-effective intervention strategy that may reduce delayed return to work.

Patient's own prediction of a poor recovery may mask an underlying low level of motivation. Studies indicate that sick leave is largely adversely affected by lack of motivation.[17, 22] Although our study did not offer specific guidelines for dealing with a lack of claimant's motivation to work, a window of opportunity might open for the medical adviser as counselor. The question of employee motivation integrates seamlessly with the issue of tolerance. Tolerance is not a scientific concept, and not scientifically measurable. Tolerance denotes the ability to put up with symptoms like pain or fatigue that accompany doing work in order to gain the rewards of labor like income and self-esteem. Claimants consider factors like income, job satisfaction and workers' compensation when deciding whether the rewards of working are worth the cost of labor. Apart from risk and capacity, tolerance issues are part of the AMA disability model in considering an individual's readiness for return to work.[52]

Many medical advisers feel ill-equipped in applying psychological interventions such as reassuring stubborn claimants and improving patient's motivation as part of their usual work. This finding supports a reappraisal of the basic professional education in disability evaluation while medical advisers require additional specific training. There is also a need to revisit the traditional disability evaluation model both in social security and private settings and to align with current clinical evidence based guidelines. A balanced curriculum

comprising interplay between disability assessment and disability management is imperative.

4. Future research

Tomorrow's challenge is to build upon this base and to offer timely and feasible interventions to high risk claimants to achieve even more tangible results. We hypothesize that when claimants are carefully selected on the basis of our screening questionnaire and when counseling competently is applied, good outcomes are to be expected. The promising results of our experiment where intervention was applied at random on low back pain claimants supports this hypothesis.

A remaining question is whether specific interventions initiated in response to claimants identified as being at risk might prevent the development of long-term disability and poor return-to-work outcomes. Our screening instrument identified the interference of pain in daily activity and patients' own prediction as potentially modifiable prognostic factors. Early intervention can be tailored to the needs of these two homogeneous subgroups of patients at risk for long-term disability. A challenge for future research will be the development and evaluation of risk factor–targeted interventions aimed at reducing catastrophizing and providing a realistic expectation of claimant's return to work. We hypothesize that some claimants will benefit from a more comprehensive intervention, whereas others need a more simple convincing reassurance.

Our prospective study highlights the importance of psychosocial predictors in early non-recovery in a compensation setting and identifies some questions of potential utility but unfortunately the screening instrument is not fully validated to recommend its use in general practice. Further research is needed to replicate and validate our brief screening questions in a large multicenter study using established screening questionnaires as the gold standard. Future studies should also determine the predictive ability of this short screening tool in patients suffering from soft tissue injuries other than low back pain.

To facilitate the RTW process, communication between medical adviser and treating physician is vital regarding the medical condition and the likely timeframe for a return to full duty. To what extent medical adviser's policy closely aligns with primary care may impact return to work and is a key issue that merits further investigation.

Our intervention did not include a workplace intervention. However, researchers at Sherbrooke university, Canada demonstrated that compared to usual care, a workplace intervention was more effective.[38] In Belgium, workplace modifications are not a common practice, even though medical advisers can legally authorize injured or diseased workers to gradually return to work; the process is then brokered in a gradual or part-time return to work agreement between employer and employee. This corresponds to a graded activity program which may be initiated on the findings from physical examination and functional capacity evaluation and claimants' expectations on time to RTW. A workplace intervention, however, deserves serious attention since its effectiveness was proven in well-designed randomized controlled trials.[49] A workplace intervention necessitates the commitment of a dedicated multidisciplinary team skilled in dealing with disability issues and incorporates at least interdisciplinary cooperation between occupational and insurance physician and the support of management and the unions.[35] Our results confirm the efficacy of advice for subacute LBP. It is anticipated that reassuring advice from medical advisers is less expensive and complicated than a multidisciplinary intervention.[19, 30] Nonetheless a workplace or multidisciplinary intervention may prove cost-effective in subgroups of LBP claimants especially those who did not gain from advice.[47, 50]

Before implementing screening and intervention, in-depth economic studies are needed to elucidate cost-effectiveness. Potential cost savings include reduction in health services use, cut in health care expenditures and economies in both social security compensation and costs to employer.

General conclusion

This dissertation highlights many important issues in the way insurance medicine deals with the enigma of disability due to low back pain. Our research started with addressing the social and economic burden of lumbar spine surgery in Belgium, as part of the LBP problems medical advisers deal with in daily practice. The present results showed that lumbar spine surgery rates are rising in the Belgian population. We found that changes in spine surgery and spinal implants did, however, not necessarily correlate with improved outcomes, whereas a shorter sick leave before surgery might be beneficial. Regional variations underscore the need for peer comparisons and surgeon feedback. Sickness funds are well positioned to play a significant role in quality improvement by providing feedback and aligning reimbursement. The role of insurance medicine in the prevention of long-term disability following LBP was elaborated in the second part of the thesis. We found that a short questionnaire comprising three items identified LBP claimants at risk for long-term disability, whereas disability counseling by medical advisers allowed for an early and safe work resumption. This dissertation has clearly demonstrated the pivotal role of insurance medicine in both safeguarding the quality of health care and preventing long-term disability.

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Abstract

Background – In western societies, low back pain (LBP) is one of the leading disorders resulting in long-term disability. In Belgium, disability is compensated through the Belgian Social security system where medical advisers of sickness funds play a key role in the disability evaluation of claimants. In daily practice, they are often confronted with claimants suffering from LBP and LBP surgery. Over the years, there has been a change of focus from disability evaluation to the prevention of lengthy sick leave by facilitating early and safe resumption of work. The bio-psycho-social model of illness is gaining acceptance among insurance physicians and has the potential to provide a basis for screening and intervention in the transition from acute to chronic LBP and disability. To date, scientific evidence for a rehabilitation oriented approach in the disability evaluation of LBP by medical advisers is lacking.

Aims – The main aim of this doctoral thesis was how the insurance physician can improve the recovery of claimants suffering from LBP and prevent prolonged disability. This objective requires a thorough understanding of the factors that influence the resumption of work following LBP to screen out claimants at risk. Given the potential role of the insurance physician as counselor, it is extremely important to evaluate whether claimant reassurance and LBP information is superior to disability evaluation alone.

To gain insight into the social and economic burden of disability due to LBP in Belgium, the present dissertation first focused on lumbar spine surgery as treatment option for LBP.

Methods – Two different study designs were employed: cohort studies and a randomized controlled trial.

The epidemiology, outcome and cost of lumbar spine surgery was investigated by a retrospective cohort study design using data obtained from records from the administrative databases from the Alliance of Christian Sickness Funds and the National Institute for Health and Disability Insurance.

Risk factors of long-term disability due to LBP were examined using a prospective cohort design in claimants suffering from LBP who were filing for sickness allowances. The study employed a battery of 12 standardized questionnaires. A similar prospective design was used to develop a brief screening tool for detecting claimants at risk for lengthy disability. Using a single-blinded randomized controlled trial design, an intervention involving patient education and support to prevent long-lasting disability was assessed in comparison to standard disability evaluation.

Results

1. Lumbar spine surgery – Belgian spine surgery rates rose 44% from 2001 through 2009. Combined discectomy and fusion rates have increased steadily since 1989 and outpaced standard discectomy. Since 2003, there was an overall upward trend in disc replacement with a yearly increase of 17%. Duration of hospital stay following lumbar spine surgery showed a large variation between Belgian hospitals and significantly decreased throughout the last decade. There was a twofold variation in provincial rates of spine surgery. Reported 1-year mortality varied from 0,6% to 2,5% among surgical procedures performed in 2008.The overall 5-year reoperation rate was 12%. The no-Return to work (RTW) rates one year after standard discectomy, ALIF and PLIF were 14,4%, 22,7% and 26,1%, respectively. The 2003 RTW rates one year after disc replacement and combined discectomy and fusion were respectively 61,5% and 50,6%. Length of sick leave before surgery was the most important factor that correlated with poor work resumption. Older age, female gender and combined discectomy and fusion were other significant factors consistently associated with no RTW one year after surgery.

Overall, type of surgery and geographic region were significantly related to patient outcomes. No significant difference between disc replacement and combined discectomy and fusion was demonstrated in terms of RTW.

2. Non-specific LBP **–** Three months after the start of the sick leave period 47% of the LBP claimants had not resumed work. The strong predictors for sickness absence lasting more than 3 months were Oswestry disability index, fear of avoidance severity score, blue collar worker, LBP for less than 12 weeks before sick leave and pain behavior. An easily applicable screening tool comprising 3 questions related to pain below the knee, patient's own prediction of RTW and interference of pain on daily activities correctly classified 73,7% of the non-resumers and 78,4% of the resumers at a cut-off score of 0,22 (c statistic = 0,801). Claimants who received information and advice showed a higher RTW rate which was statistically significant at one year of sick leave mainly due a lower relapse rate. There was no effect on subsequent surgery for LBP and duration of sick leave.

Conclusion **–** The current study on lumbar spine surgery demonstrated that the analysis of health insurance claims is a useful adjunct to surveillance of changes in spine surgery and their impacts. Regional variations in particular call for a more consistent approach to clinical care and to peer-review current practice against evidence- and consensus- based clinical guidelines. Patients eligible for spine surgery should be screened for the length of sick leave before surgery since it was the most important factor associated with outcome. Surgeons should bear in mind the non-superiority of disc replacement surgery in the short run compared with combined discectomy and fusion.

A brief screening tool comprising three questions related to pain below the knee, patient's own prediction of RTW and interference of pain on daily activities is a useful means of identifying LBP claimants at risk of prolonged disability. Especially patient's own prediction is a potentially modifiable risk factor and may be amenable to

intervention. Reassurance and education on LBP should be part of a disability evaluation to allow early and safe RTW.

Samenvatting

Achtergrond – Lage rugpijn is een van de belangrijkste oorzaken van langdurige arbeidsongeschiktheid in de Westerse samenleving. De Belgische sociale zekerheid voorziet in een vervangingsinkomen voor arbeidsongeschiktheid na evaluatie door de adviserende geneesheer van het ziekenfonds. In hun dagelijkse praktijk worden deze verzekeringsartsen dikwijls geconfronteerd met patiënten die arbeidsongeschikt werden ten gevolge van rugpijn of na een rugoperatie. De laatste jaren heeft er een duidelijke accentverschuiving plaatsgevonden van de arbeidsongeschiktheidsevaluatie naar de preventie van langdurige arbeidsongeschiktheid door het streven naar een snelle en veilige werkhervatting. Het bio-psycho-sociaal ziektemodel wint aan belangstelling in de verzekeringsgeneeskunde en kan een basis vormen voor screening en interventie tijdens de overgang van acute naar chronische arbeidsongeschiktheid door rugpijn. Tot op heden is er echter geen wetenschappelijk bewijs voor een gecombineerde verzekeringsgeneeskundige evaluatie en begeleiding met het oog op de professionele re-integratie van patiënten met lage rugpijn.

Doelstellingen – Het voornaamste objectief van dit proefschrift is te onderzoeken op welke wijze de verzekeringsgeneeskundige in zijn rol als begeleider kan bijdragen tot het herstel en preventie van langdurige arbeidsongeschiktheid bij rugpijnpatiënten. Deze doelstelling vereist een grondig begrip van de determinanten van langdurige arbeidsongeschiktheid wegens lage rugpijn. Zij kunnen immers een rol spelen in de vroege detectie van risicopatiënten op langdurig ziekteverzuim. De potentiële rol van de verzekeringsgeneeskundige als begeleider wordt nagegaan in de effecten van een arbeidsongeschiktheidsevaluatie gericht op snelle mobilisatie en re-integratie.

Om inzicht te verwerven in de sociale en economische impact van arbeidsongeschiktheid ten gevolge van rugpijn in België, zal de aandacht van dit proefschrift in een eerste fase uitgaan naar patiënten die heelkundig behandeld werden omwille van rugklachten.

Methoden – Dit proefschrift vormt de neerslag van zowel cohortstudies als gerandomiseerd, gecontroleerd onderzoek. In een retrospectief studieopzet werd de epidemiologie, het resultaat en de kostprijs van lumbale rugheelkunde bestudeerd op basis van administratieve data van de landsbond der Christelijke Mutualiteiten en het Rijksinstituut voor de Ziekte- en Invaliditeitsverzekering. In een prospectief cohortopzet werd onderzoek gedaan naar de voorspellende factoren van langdurige arbeidsongeschiktheid bij patiënten die zich arbeidsongeschikt meldden wegens lage rugpijn. In deze studie werden twaalf gestandaardiseerde vragenlijsten gebruikt.

In een gelijkaardig prospectief studieopzet werd een screeningsinstrument ontwikkeld om patiënten met een risico op langdurige arbeidsongeschiktheid op te sporen. Tot slot werd in een enkelblind, gerandomiseerd, gecontroleerd onderzoek nagegaan of een verzekeringsgeneeskundige interventie gericht op gezondheidsvoorlichting en ondersteuning in een snellere en duurzame werkhervatting van patiënten met lage rugpijn resulteert in vergelijking met een standaardevaluatie voor arbeidsongeschiktheid.

Voornaamste bevindingen

1. Lumbale rugchirurgie – De operatiecijfers voor lumbale rugheelkunde stegen met 44% gedurende de periode 2001-2009. Het aantal gecombineerde discectomie en fusieoperaties zijn sinds 1989 gestaag gestegen en sneller dan de standaarddiscectomie. Sinds 2003 was er tevens een algemeen groeiende trend in lumbale arthroplastie met een jaarlijks stijgingspercentage van 17%. We konden een grote variatie in hospitalisatieduur vaststellen tussen de Belgische

ziekenhuizen met een significante vermindering in duur tijdens het laatste decennium. De provincies toonden een tweevoudige variatie in operatiecijfers voor lumbale rugchirurgie. In 2008 varieerde de postoperatieve mortaliteit tussen 0,6% en 2,5%. Het aantal heringrepen over 5 jaar bedroeg 12%. Het aantal patiënten dat één jaar het werk niet hervatte na standaarddiscectomie, ALIF en PLIF bedroeg respectievelijk 14,4%, 22,7% en 26,1%. Het werkhervattingspercentage één jaar na het plaatsen van een discusprothese en na gecombineerde discectomie en fusie bedroeg respectievelijk 61,5% en 50,6%. Multivariate analyse toonde aan dat langdurige arbeidsongeschiktheid vóór de ingreep de belangrijkste significante factor was voor latere blijvende arbeidsongeschiktheid. Langdurige arbeidsongeschiktheid was tevens geassocieerd met oudere leeftijd, vrouwelijk geslacht en gecombineerde discectomie en fusie. Aard van de heelkundige ingreep en regio correleerden significant met het resultaat na heelkunde. We konden geen significant verschil aantonen in werkhervatting tussen de discusprothese en de gecombineerde discectomie en fusie.

2. Niet-specifieke lage rugpijn – Zevenenveertig procent van de populatie kon het werk niet hervatten na drie maanden arbeidsongeschiktheid. De belangrijkste risicofactoren voor arbeidsongeschiktheid na drie maanden waren de Oswestry Disability Index, Fear of Avoidance ernstgraad, arbeider, lage rugpijn op minder dan drie maanden vóór ziekteverzuim en pijngedrag. Een eenvoudig en handig screeningsinstrument gebaseerd op pijn onder de knie, de voorspelling van arbeidsongeschiktheid door de patiënt zelf en de invloed van pijn op de dagelijkse activiteiten kon 73,7% van de arbeidsongeschikten en 78,4% van de werkhervatters correct classificeren met een *cut-off*-score van 0,22 (c statistiek = 0,801). Arbeidsongeschikte rugpijnpatiënten die informatie en advies ontvingen, kenden een statistisch significant hogere werkhervatting na twaalf maanden arbeidsongeschiktheid ten gevolge van een lager herval. We konden echter geen effect aantonen op de arbeidsongeschiktheidsduur noch op een eventueel operatief ingrijpen.

Conclusie – Het onderzoek naar lumbale rugchirurgie toont aan dat analyse van arbeidsongeschiktheidsdata nuttig en aanvullend is voor de opvolging van de ontwikkelingen in spinale heelkunde en hun impact op de volksgezondheid. Regionale verschillen in het bijzonder duiden op de noodzaak tot een meer consistente benadering in rugchirurgie en tot een interne evaluatie van de huidige praktijk in het licht van vigerende richtlijnen op basis van consensus en evidentie. Kandidaat-patiënten voor rugchirurgie zouden moeten worden gescreend op de lengte van de arbeidsongeschiktheidsduur omdat dit de belangrijkste factor is die geassocieerd blijkt met het heelkundig resultaat. Chirurgen moeten er zich tevens van bewust zijn dat een discusprothese op korte termijn geen meerwaarde biedt ten opzichte van de gecombineerde discectomie en fusie.

Een eenvoudig screeningsinstrument is een nuttig middel in de opsporing van patiënten met een risico op langdurige arbeidsongeschiktheid. De voorspelling van de patiënt is een bijzondere risicofactor die modificeerbaar is en hierdoor een potentieel doelwit vormt voor interventie. Geruststelling en gezondheidsvoorlichting moeten deel zijn van elke arbeidsongeschiktheidsevaluatie met het oog op een snelle en veilige werkhervatting.

About the author

Marc Du Bois, born April 30 1968, graduated Magna Cum Laude from the Catholic University of Louvain with a doctor of medicine degree. From 1995 to 1998 he was appointed as a scientific researcher at the department of Occupational and Insurance Medicine at the School of Public Health. In the meantime he received his Master of Occupational Medicine and his Master of Insurance Medicine and Medico-legal Expertise. Dr. Du Bois also holds a Postgraduate Certificate in Business Administration, a Bachelor in Public Health and successfully completed an education as judicial expert.

Currently, he serves as a staff member on the board of medicine for the Alliance of Christian Sickness Funds. His areas of research interest include disability assessment and management of low back pain, impairment rating and the investigation of medical malpractice cases. Dr. Du Bois is board certified in insurance medicine. He has authored several articles, book chapters and other publications, mainly about his research on low back pain disability.

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